PC MAGAZINE LIBRARY

CIRCULATING COPY

Please Return Promptly

ONAL COMPUTING MARCH 30, 1993 VOLUME 12 NUMBER 6 $2.95

PC MAGAZINE

'C Labs Tests

31 PORTABLES

Closing In on Desktops

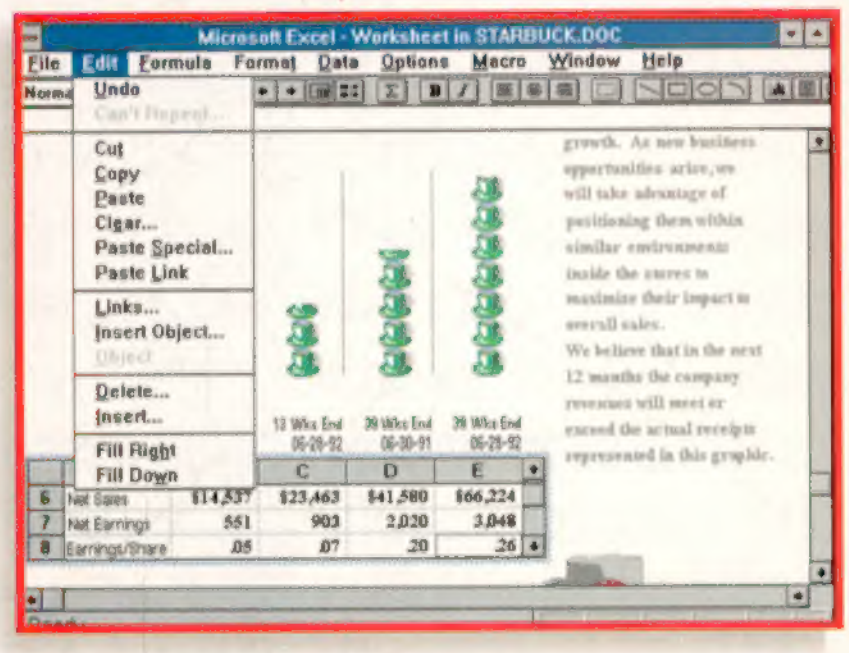
Illustration Software: Six Packages Designed To Please

Routers: An In-Depth Look at Smart Hardware For LANs

MAKING YOUR PROGRAMS WORK TOGETHER

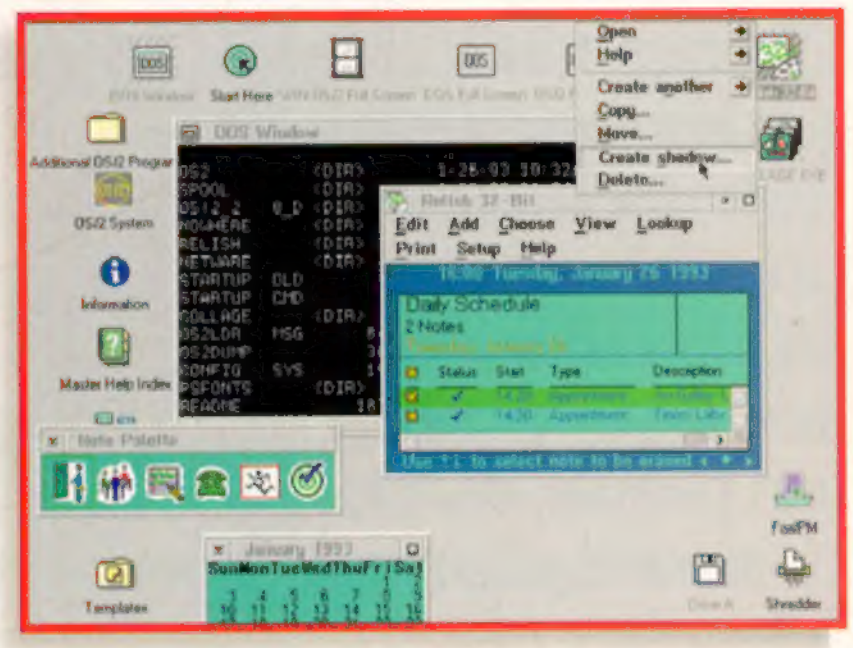
Microsoft Windows • OLE

Using Object Linking and Embedding, Windows lets you combine data among several applications.



IBM's OS/2 • SOM

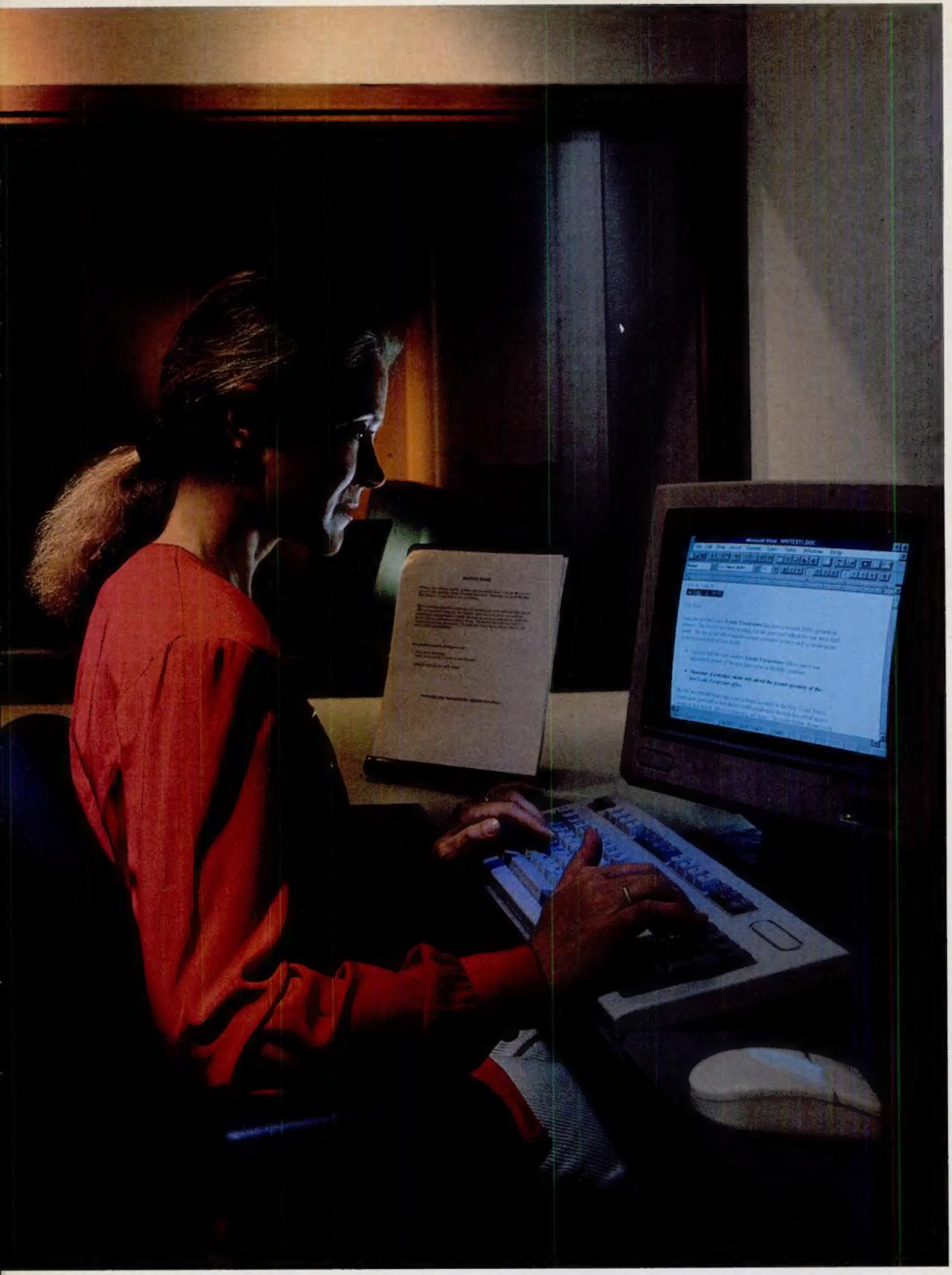
OS/2's System Object Model extends the power of the Workplace Shell to all your applications.



- A Guide to Connecting Applications
- Techniques for Integrating Your Work
- Software Makers' Strategies

13
02391
0 140246 9

It's not surprising that WordPerfect users are switching to Microsoft Word for Windows.



Hey dBASE U
And Smell T

Adding a GUI to existing dBASE applications is fast and easy with CA-dBFast.

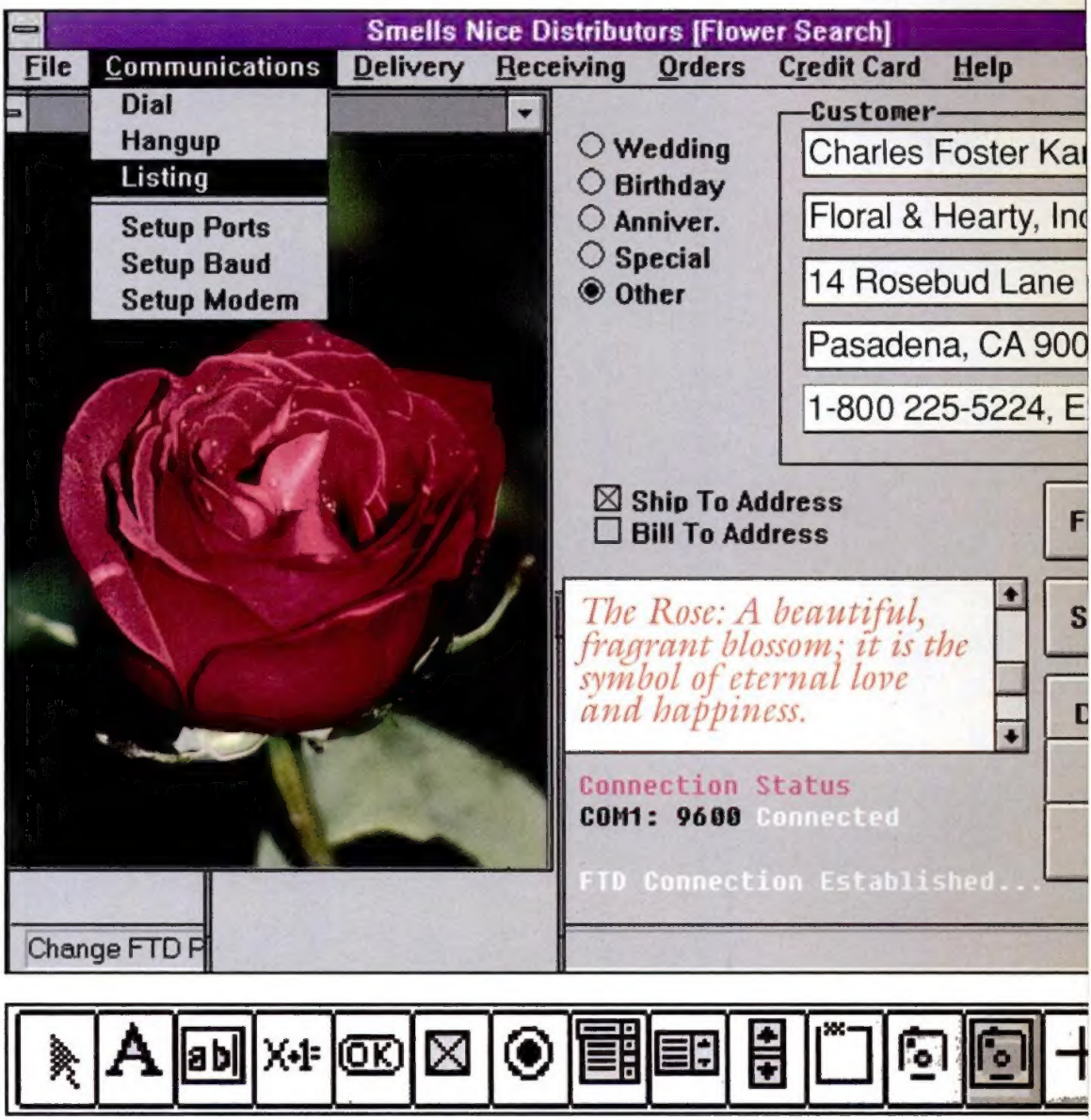
CA-dBFast's report writer, CA-RET, lets you mix text, graphics and data to produce great-looking reports in minutes.

The Visual Application Designer lets you interactively create and modify the user interface within a graphical environment.

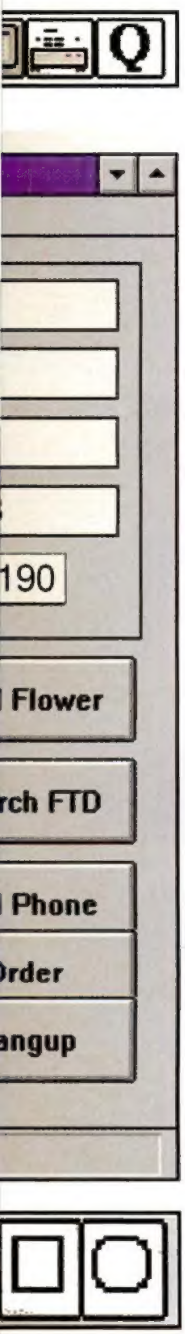
CA-dBFast is the first and only way to get graphics, including bit-maps, into Xbase applications.

CA-dBFast is a complete Xbase language development system, including an Editor, Compiler, Debugger, Application Designer and Runtime Generator.

Integration with other Windows programs is available through Dynamic Data Exchange, Dynamic Link Libraries and the Windows clipboard.



sers, Wake Up he Windows.



CA-dBFast includes Windows interface objects for pull down menus, push buttons, radio buttons, check boxes, scrolling list boxes, bit-mapped graphics and more.

The runtime compiler can produce client-server applications that support Novell Netware, LAN Manager, LANtastic and any Net-BIOS compatible LAN system.

There's only one database that can take .DBF files into Windows: CA-dBFast. Support for standard Xbase file formats also includes .NTX, .FRM and .LBL files.

The Editor can now support up to 10 open documents at once – with the look and feel of Windows word processing.

You can set and save personal preferences on Editor fonts, tab settings, colors and indentation.

A new day is dawning for millions of dBASE developers – thanks to new CA-dBFast 2.0, the first and only dBASE-compatible database and language for Windows.

CA-dBFast meets two giant needs: moving existing dBASE applications to Windows *and* developing dazzling new applications in record time. It's the one solution that lets you take advantage of Windows while protecting the huge investment you've made in Xbase technology.

With CA-dBFast 2.0, you get a proven, stable environment that's more visual and more intuitive than anything you've ever used. And there's no need for Microsoft's confusing, intimidating SDK, so creating applications with CA-dBFast is, true to its name, fast.

MICROSOFT® WINDOWS™ COMPATIBLE

The Visual Application Designer (VAD) makes creating pull-down menus, push buttons, radio buttons, check boxes, scrolling list boxes and other Windows objects as easy as "point and click" or "drag and drop." The VAD generates the required source code, saving you hours of complex programming. You also get a debugger that's so advanced, it lets you watch your source code execute at run time – even Single Step through execution.

COMPUTERWORLD BEST PRICE/PERFORMANCE

1992 W 100 WINDOWS MAGAZINE ANNUAL WIN AWARD

CA-dBFast 2.0 also includes CA-RET – an outstanding Windows-based report writer that lets you mix text, graphics and data on the same report in a full WYSIWYG environment. Creating great looking tabular reports, form letters or labels is as easy as using a word processor.

FOR A FREE DEMO DISK, CALL 1-800 CALL CAI, Ext. 190.

Free Demo Disk

With CA-dBFast applications, there are no license fees, royalties or key diskettes to bother with. And recipients of runtime programs don't need CA-dBFast to run the application – just Windows. CA-dBFast is also compatible with CA-CLIPPER, dBASE III Plus, dBASE IV and FoxBASE.

So whether you want to wake up old applications or build brilliant new ones, you can't afford to sleep through this revolution.

Check out CA-dBFast today.

COMPUTER ASSOCIATES
Software superior by design.

New CA-dBFast Release 2.0.

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11788 7000. All product names referenced herein are trademarks of their respective companies.

CIRCLE 348 ON READER SERVICE CARD

LAPTOP
ULTRAVISION™
"If you buy only one laptop utility, make it Laptop UltraVision"
PC Magazine - Oct 13, 1992
Give your portable PC a great-looking screen. See why nearly every major PC publication has called UltraVision a "must-have" utility for laptop owners. You may not believe your eyes. Available now at Egghead, CompUSA and other fine dealers.
1-800-445-3311

personics
A DATAWATCH COMPANY
234 Ballardvale St, Wilmington, MA 01887
CIRCLE 026 ON READER SERVICE CARD

Inside

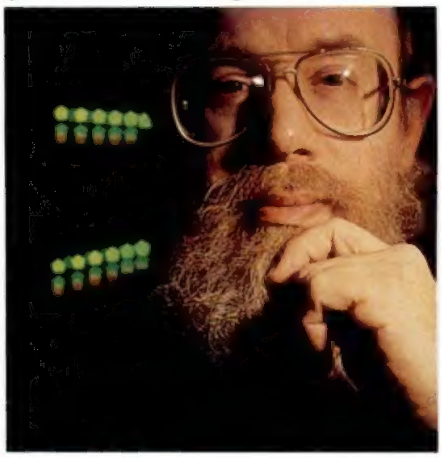
To many people, a complex computer network's hardware is so much plumbing. But unlike the plastic and copper pipes that bring water into your home, a PC network's infrastructure has to be pretty darn smart.

The router is the best example of intelligent network hardware. This piece of equipment is critical for connecting several PC networks into a wide-area network. A router is a kind of traffic cop that speeds your data, provides your networks with security by controlling what kind of data goes in and out, and isolates segments of your networks to protect them or make them easier to maintain.

This versatility also makes routers very difficult to test. For our review of routers in this issue, associate editor David Greenfield sought the help of a renowned expert. There was only one candidate: Scott Bradner, consultant to Harvard University's Office of Information Technology.

"He is the only independent router expert in the country," says Greenfield. "He's done more router testing than anyone else." Bradner annually conducts high-level performance tests at the Harvard University Network Device Test Laboratory. For this story, we used the results of his tests to determine these routers' performance. In addition, ZD Labs tested the ease of use for these ten routers.

It turned out that Bradner's expertise—and our lab tests—were much needed. Greenfield reported that many of the participating vendors misconfigured their own products when setting them up for our tests. Bradner and our PC Labs folks were able to fix these glitches in time to produce the story "Building the Highway."



Router expert Scott Bradner.

As he has done for previous router evaluations, Bradner will post detailed results of his router performance tests on the Internet network. If you need more information, you can access it from Internet or in PC MagNet's Editorial Forum.—*Joel Dreyfuss*

PC Magazine: The Independent Guide to Personal Computing, ISSN #0888-8507 is published biweekly except in July and August for $44.97 for one year. Ziff-Davis Publishing Co., a division of Ziff Communications Co., One Park Ave., New York, NY 10016. Second-class postage paid at New York, NY 10016 and at additional mailing offices. POSTMASTER: Address changes to **PC Magazine,** P.O. Box 54093, Boulder, CO 80321-4093.

Photograph by Steve Lewis

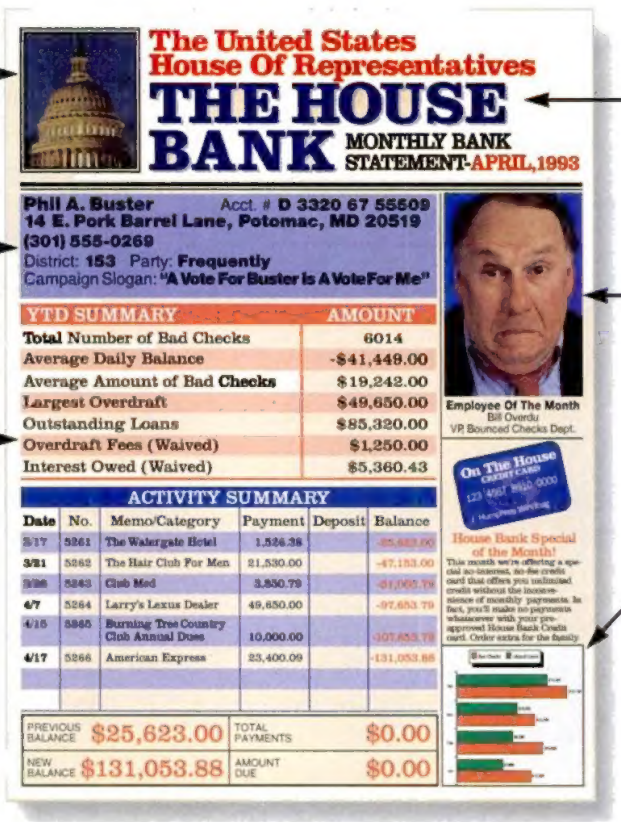
Now Even Bad Reports Can Look Good.

New CA-RET™ 1.0: The Friendliest, Most Powerful Report Writer Ever.

Add bitmapped images anywhere in your report for graphic impact.

Create exciting output from your CA-Clipper, dBASE and text files.

Dozens of built-in number-crunching functions are available for powerful data analysis.



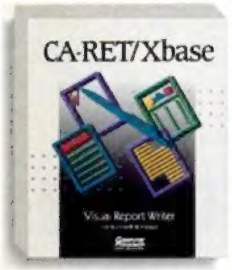
Using different fonts adds pizzazz to your reports. CA-RET makes it a snap.

The allure of color: You get it in an easy, WYSIWYG environment.

You can even turn your data into eye-catching graphs.

Whatever the news, make it look great with new CA-RET/Xbase, the visual report writer for Windows.

With drag and drop, WYSIWYG design, it's as easy to use as a word processor, yet powerful enough to produce stunning results. Choose a wide variety of pre-formatted tabular layouts, labels and form letters – or create your own. Now you can add dazzling color, fonts and bitmaps to any report.



Place database fields, computed fields and aggregate computations anywhere and use the more than 40 built-in functions for extensive analysis.

And CA-RET's single-pass computation engine is the most efficient available.

From dBASE to Clipper, CA-RET/Xbase works with top databases (or text files) and acts as a DDE server so you can include reports in other Windows applications. And the unlimited use runtime license lets you distribute report applications for free.

MICROSOFT WINDOWS COMPATIBLE

SPECIAL OFFER FOR R&R USERS.

Registered users of R&R Report Writer for Xbase can upgrade to CA-RET for just $79 ($89 in Canada). To order, just call 1-800-531-5236 (in Canada: 1-800-665-5449).

Call today and find out how easy it is to turn the mundane into the magnificent.

COMPUTER ASSOCIATES®
Software superior by design.

© Computer Associates International, Inc., One Computer Associates Plaza, Islandia, NY 11788-7000.
All product names referenced herein are trademarks of their respective companies.

CIRCLE 400 ON READER SERVICE CARD

Special Offer!

Best spreadsheet. Best price.

Quattro Pro for Windows beat every other software application to win *PC Magazine*'s award for Technical Excellence.
PC Magazine
December 1992

"Greatly simplifies the use of 3-D worksheets for the average user."
PC Week
January 4, 1993

November 10, 1992
Quattro Pro for Windows

"Most significant developments in terms of innovation, performance, and price."
BYTE
January 1993

"Two out of three current Excel and 1-2-3 users preferred Quattro Pro for Windows."
Usability Sciences Corporation
October 1992

Quattro Pro for Windows

But don't take our word for it . . .

OBJECT COMPUTING NOW!

"Quattro® Pro for Windows is the most advanced, most forward-looking Windows spreadsheet to date."
—Michael Miller, *PC Magazine*, December 1992

"Quattro Pro for Windows is a better spreadsheet than Excel 4.0."
—*BYTE*, Essential Guide to Windows, 1992

"Quattro Pro for Windows is easy to use, powerful, and provides large organizations with the flexibility they need for managing vast amounts of information."
—Chris Aher, MCI International

"Quattro Pro for Windows is the easiest to use and has the best graphics and development tools. It's better integrated than either of the other programs."
—*Computer Shopper*, November 1992

"[It's] far superior to Microsoft® Excel or Lotus 1-2-3. The entire design of Quattro Pro for Windows gives us a significantly better way to manage data."
—Don Chase, Washington State Department of Wildlife

"Quattro Pro for Windows is an uncompromised productivity tool. Borland has always been one step ahead of the competition for quality software and top-notch customer support."
—Prudential Bache Securities, Inc.

"Quattro Pro provided the best transition from 1-2-3 [compared to Excel and 1-2-3 for Windows]."
—*PC World*, January 1993

"The interface in Quattro Pro for Windows [is] so much better than other vendors.... We reaped the benefits of a great idea already hammered into a highly usable form."
—Jim Seymour, *PC Week*, December 1992

". . . it's enough to make an experienced Excel user want to switch."
—Christopher Lindquist, *Computerworld*, October 1992

Special offer—act now!
Offer expires April 30, 1993.

$99.95
(regular list price $495)

See your dealer or call now, 1-800-336-6464, ext. 6094
In Canada, call 1-800-461-3327.

90-DAY GUARANTEE MONEY-BACK

Borland® Quattro® Pro for Windows

Copyright © 1993 Borland International, Inc. All rights reserved. All Borland product names are trademarks of Borland International, Inc. Quattro Pro for Windows has patent pending. Offer good in the United States and Canada only. All prices are in U.S. dollars. BI 5183

CIRCLE 285 ON READER SERVICE CARD

March 30, 1993 Volume 12 Number 6

UP FRONT

Inside
Intelligent hardware: network routers 4

Letters
What's new about MS-DOS 6.0? 19

Trends
- PDA players partner up
- NT spawns SMP systems
- Ergonomic keyboards
- Compression API wars ..29

First Looks
- Microsoft Windows Printing System
- Tektronix Phaser 200i
- Sound Blaster 16 ASP....37

New and Improved
BY BRAD GRIMES 58

Read Only
EDITED BY CAROL LEVIN 71

Toolkits
EDITED BY TRUDY NEUHAUS 77

COLUMNISTS

Michael J. Miller
The Next Software Revolution....81

Bill Machrone
Finally: A Reason for Multimedia....87

John C. Dvorak
The PC Zombie Haunts the Future....93
Inside Track 95

Jim Seymour
Novell and Unix: A Good Fit 99

Bill Howard
The Politically Correct PC....105

COVER STORY

Applications Integration

Making Your Applications Work Together

BY MICHAEL J. MILLER You use half a dozen applications regularly and you'd like to share data among them. But it's not easy. In this report, we walk you through the strategies the major software vendors are developing to help you get the most out of your applications. We cover everything from simple imports and exports to advanced techniques, and we offer some examples to help you survive while you wait for the object-oriented desktop of the future....108

Import and Export 110
Cut, Copy, and Paste....112
Linking Applications 112
Embedding with OLE 1....116
Modular Applications....116
OLE 2.0 122
Macro Languages....128
Future Object-Oriented Systems....128
Navigating Applications Integration 138
Company Strategy: Microsoft...111
Company Strategy: Borland International 113
Company Strategy: Lotus Development Corp....121
Company Strategy: Computer Associates International 126
Company Strategy: WordPerfect Corp. 128
Company Strategy: IBM 136

You *can* get there from here. Compound documents made from many applications add richness to your message (page 108).

PC MAGAZINE March 30, 1993 Volume 12 Number 6

FEATURES

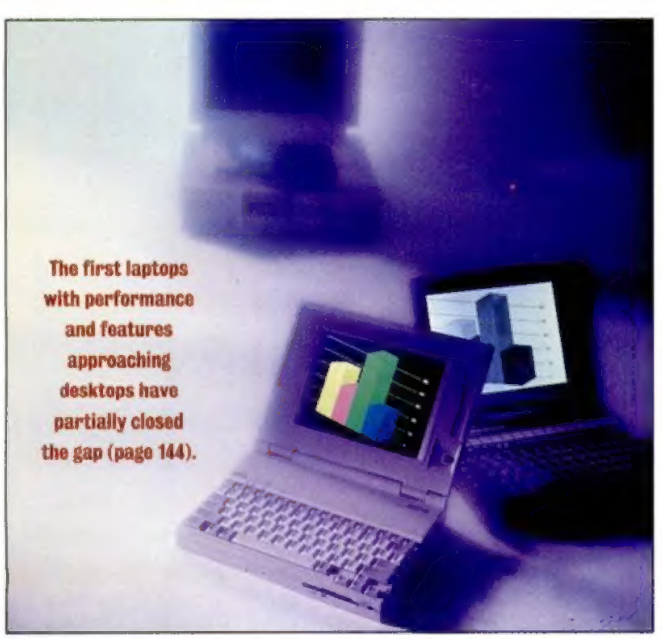
Portable PCs

The Laptop Gap

BY BILL HOWARD As computer makers squeeze more and more desktop features into and get greater battery life out of notebooks, buyers continue to demand even more. *PC Magazine* tests 31 of today's mobile powerhouses **144**

Aspen Personal 486 153
AST PowerExec 3/25SL 160
BCC Avanti 486/V32 Model 200 166
BSI NB486DX2-50 166
CAF AquaLITE-II 173
Compaq Contura 3/25C 173
Compaq LTE Lite 4/25C 174
Compaq LTE Lite/25E 176
CompuAdd 425C 176
PC Brand 486/SLC Color LeaderBook 176
Ergo Modular Color 486SLC NoteBrick 182
Ergo Modular 486SLC NoteBrick 182
Ergo Nifty Fifty 486/50 Color NoteBrick 187
Expo Note 33 187
GRiD 1660C 188
Hyundai Courier Spectra 188
IBM ThinkPad 300 191
IBM ThinkPad 700 191
IBM ThinkPad 700C 191
Northgate ZXPortable Active Color 194
Northgate ZXPortable 486DX/25 194
Poly NB433DX 196
Sharp PC-6881 200
Sharp PC-7750 200
Swan 486/SLC-25 Notebook 201
Tenex Notebook 386DXL/33 202
TI TravelMate 4000 WinDX2/50 207
TI TravelMate WinSLC 207
Toshiba T4400C 216
Transource Verxion NB8004 217
U.S. Professional Notebook 486DX 218

Highlights 147
Editors' Choice 148
Suitability to Task 150
Price/Performance Index 152
Recent Reviews 153
Battery Life vs. Portability 158
Performance Tests 160
Traveling Trackballs 180
State of the Slate: Pen-Based Computers 192
Double-Duty Duo 200
Summary of Features 202
Gulliver Travels 214



The first laptops with performance and features approaching desktops have partially closed the gap (page 144).

Networking

Routers: Building the Highway

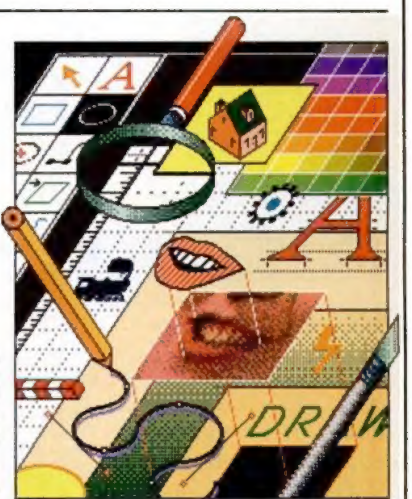
BY SCOTT BRADNER AND DAVID GREENFIELD Manageability, not speed, is crucial for network routers. We look at the management and performance features of ten leading products. **221**

ACS 4200 244
Cisco AGS+4 245
Constellation Pixis 248
HP Router ER 249
IBM 6611 Network Processor 140 252
NSC 6607 Bridge-Router 259
Novell MultiProtocol Router, Version 2.0 264
Proteon ProNet DNX-300m 266
NETBuilder II 269
Network 9000 Intra-Networking Hub 270

Editors' Choice 223
Suitability to Task 224
How Routers Pass Information 230
Performance Tests 236
Summary of Features 258

Graphics

Professional Illustration: In Pursuit of Truth and Beauty



BY JAMES KARNEY Has the art supply house moved into the PC? These six illustration programs make it look that way. With sophisticated drawing tools and seamless handling of 24-bit color, they give users some of the most powerful creative tools ever **275**

Adobe Illustrator 280
Aldus FreeHand 282
Arts & Letters Graphics Editor 289
CorelDRAW 290
Designer 298
Professional Draw 303

Suitability to Task 278
Let's Get Technical 288
Two New Faces for OS/2 292
Editors' Choice 296
Summary of Features 299

PC —Available on PC MagNet.

TECHNICAL COLUMNS

User-to-User

PC MAGNET BY NEIL J. RUBENKING Find the length of a string by turning a DOS limitation into an asset....309

Tutor

BY JEFF PROSISE Viruses: How They Work and How to Avoid Them 311

Utilities

PC MAGNET BY DOUGLAS BOLING Quick-Boot Your PC and Protect Your Data with BOOT2C and BOOTPW 314

Environments

PC MAGNET BY CHARLES PETZOLD An Introduction to OS/2 Outline Fonts....322

Power Programming

EDITED BY RAY DUNCAN Export Tables in Windows NT Executable Files....329

Johnny Castaway: The first screen saver with a plot (page 450).

Solutions

PCs

How to obtain distribution disks for programs preinstalled on new PCs; keeping your notebook's battery charged 344

Operating Environments

Uncovering the hidden Windows swap file; new features of the ATTRIB command in DOS 5.0....345

Word Processing

A shortcut that lets you reformat a paragraph to match the format of a previous paragraph....347

Spreadsheets

A clever way to include functions in Excel's chart-series formulas 347

Databases

PC MAGNET Finding the beginning and end of the month in Paradox; converting text to proper format in dBASE....349

Graphics

Creating scalable fonts in foreign languages for TrueType and PostScript; getting .EPS files to print correctly in landscape mode 351

Networking

Make sure to install unshielded twisted-pair wire properly; using analog modems with digital phones....354

Languages

PC MAGNET BASIC and C programs that illustrate how to access the video buffer directly 363

Vertical Applications

Manage your hotel or motel more efficiently with specialized software packages....378

AFTER WORDS

After Hours

- **Screen Savers**

PC Dynamics' Energizer Bunny, Dynamix's Johnny Castaway, Access Softek's Matinee, Berkeley System's Star Trek: The Screen Saver

- **Sound Bites**

Moon Valley Software's Icon Hear-It, Microsoft Soundbits, Window Ware's Soundwav Pro, Sound Source Unlimited's Star Trek and 2001: A Space Odyssey, Aristosoft's Wired for Sound Pro 450

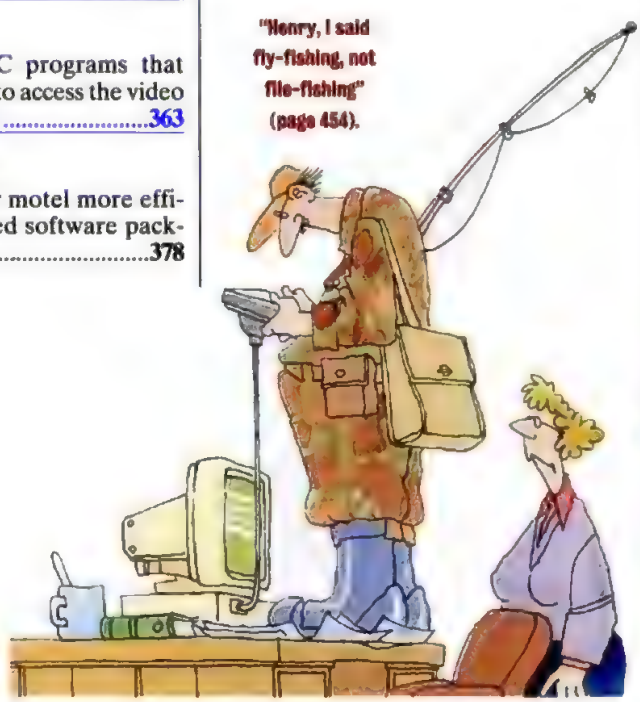
Abort, Retry, Fail?

BY ROBIN RASKIN 454

ALSO IN THIS ISSUE

PC Direct 335
Marketplace Index....418
Premier....418
Classified....428
Business Card 436
Reader Service Card....437
Index to Advertisers 445
Advertisers' Product Index....446
Coming Up....448
Editorial Product Index....449

"Henry, I said fly-fishing, not file-fishing" (page 454).



Are You Sm
Microsoft Th

INTRODUCING SUPERBASE™ VERSION 2.0.

It's the one and only Windows™ database that works for everyone.

Our competition seems to think that you need two databases to do serious applications, one database for developers and another for users. Not so. Software Publishing Corporation has put it all into one clearly superior database that'll get developers and their users working together. Instead of against one another.

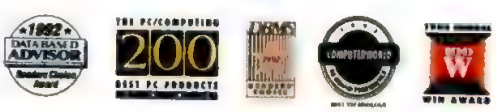
That one database is Superbase version 2.0.

It offers all the power and sophistication developers demand. The point-and-click simplicity users crave. And for IS managers, the pleasure of supporting one database. Instead of two.

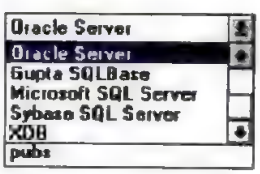
A quick tour of this ad will give you some idea of just how good Superbase version 2.0 really is. And then, if you're as smart as we think you are, you'll want to get your hands on a copy of the real thing. Superbase version 2.0. The one that works for everyone.

A Standard For Everyone. And A Place For Everything.

Beneath its standard easy-to-use Windows interface, you'll find everything from files that can be a billion records deep to advanced multimedia capabilities and direct support for 15 popular image formats. And all this on a high performance database engine that's lightning fast even on 386® machines.



Everyone Loves A Winner. *Superbase version 2.0 just won Windows Magazine's 1993 Win Award. Moreover, earlier versions of Superbase have racked up awards for years, including every 1992 Readers' Choice Award worth winning. All this while our Windows competitors are still wet behind the ears.*



It Connects Everyone To Everything.

Wherever your existing data exists, users can get there from here. Superbase version 2.0 directly reads and writes data from dBase® files. Imports and exports Paradox®, Excel® and Lotus® files. There's support for OLE, DDE and DLL. And (developers rejoice) our optional Superbase SQL Library lets you build applications with direct access to SQL databases throughout your organization.

Call 1-800-336-8360, Op. 506 For A Free IntroPack or $199 Competitive Upgrade.

**Competitive upgrade offer ends March 31, 1993. Superbase, the Superbase Selection Bar and the Software Publishing Corporation logo are registered trademarks of Software Publishing Corporation or related companies. Software Publishing Corporation acknowledges*

arter Than inks You Are?

Everyone Should Be So Productive. *With Superbase version 2.0 both users and developers will be more productive than ever before. With our new graphical Query by Example (QBE) feature, for instance, users can select data by simply pointing and clicking on the QBE icon. And the Quick Report feature is a real time saver for both users and developers, providing point-and-click data summary and page layout controls.*

Tools Everyone Can Use. *Real developers will find our procedural, event-driven Super Basic Language familiar and easy to use. And everyone, developers or not, will be right at home with object-oriented visual development tools like our powerful Form Designer. Which lets you create screens, file links and multiple master/detail data relationships. All without time-consuming coding, as our Macro Recorder automatically generates the code.*

How To Give Everyone An Icon Of Their Own. *The Superbase version 2.0 Icon Bar is fully and easily customizable. With minimal programming, developers can give every application an interface that makes perfect sense to everyone. Which, in turn, saves users learning time and IS managers support time.*

There's Even An Offer That Works For Everyone. *If what you see here looks interesting, now's the time to act. Because for a limited time* we're offering Superbase version 2.0 (SRP $795) for only $199 to everyone using any DOS or Windows programmable database. See your software reseller or call the number below. Quick, before everyone else does.*

Superbase version 2.0. The One That Works For Everyone. SPC SOFTWARE PUBLISHING CORPORATION

all trademarks and the rights of trademarks owned by the companies referred herein. © 1990 Software Publishing Corporation, 1165 Kifer Road, Santa Clara, CA 95052. All rights reserved.

PC MAGAZINE

Editor-in-Chief Michael J. Miller

Editor Joel Dreyfuss
Executive Editors Bill Howard, Robin Raskin

Director, PC Labs C. James Galley III **Art Director** David Herbick

Senior Networking Editor Frank J. Derfler, Jr.
Senior Editors Christopher Barr (West Coast), Trudy Neuhaus (Technical Columns), Don Willmott (First Looks)

Managing Editor Paul B. Ross
Assistant Managing Editor Dianne H. McDonald

Manager, Copy Edit Karen A. Carter **Associate Editors** Sheryl Canter (Applications Development), Julie Cohen (After Hours), Mary Kathleen Flynn (Trends), David Greenfield (Networking and Communications), Lori Grunin (Graphics), Brian Nadel (PCs), Ted Stevenson (Software), Sharon Terdeman (Technical Columns), Jennifer Zaino (Hardware) **Technical Editor** Neil J. Rubenking **Production Editors** Shari L. Girouard, Kim Schueler **Copy Chief** Glen Boisseau Becker **Staff Editors** Jamie M. Bsales, Gayle C. Ehrenman, Angela Gunn, Catherine Kunkemueller, Carol Levin, Michael W. Muchmore, Ann Ovodow, Craig L. Stark, Emerson A. Torgan, Lance N. Ulanoff **Senior Writer** Robert S. Anthony **Staff Writer** Oliver Rist **Copy Editors** Jeanne Albrecht, Robin B. Bornstein, Elisabeth H. Holzer, Kimberly Lee, Jill Léger, Bob Sillery **Assistant Copy Editor** N. Jeanne Smith **Assistant Editors** Brad Grimes, Ellyn McCasland **Layout Manager** Linda Harms **Assistant Layout Manager** Shelly Fierston **Senior Layout Editors** Thomas DeVito, Lillian Gaffney **Layout Editor** Michael L. Graham **Librarian** Thomas W. Giebel **Library Assistant** Dolores Williams **Editorial Researchers** Daniel A. Begun, Camille N. Cline, Angela Hickman, Adam A. Hicks, Andrew C. Kantor, Brad Stilwell, Anush Yegyazarian **Editorial Assistant** Tin Albano **Business Manager** Justine Casey Gaeta **System Support Manager** Craig Ellison **PC Support Analyst** Melvin Acevedo **Production System Support Manager** Pat Perkowski **Communications Manager** Allison Playford **Assistant to the Editor-in-Chief** Tara Hoffinger **Assistant to the Editor** Rita Aprahamian **Assistant to the Executive Editors** Christina M. Evelyn **Administrative Assistant** Christina Okang **Support Associate, PC MagNet** Louise Laberge **Sysop, PC MagNet** Ken Hipple

Contributing Editors Bill Machrone (Publishing Director), Douglas Boling, Bruce Brown, Ray Duncan, John C. Dvorak, Mitt Jones, Michael J. Mefford, Edward Mendelson, Bill O'Brien, Charles Petzold, Alfred Poor, Jeff Prosise, Sal Ricciardi, Winn L. Rosch, Joe Salemi, Jim Seymour, Richard Hale Shaw, Barry Simon, Luisa Simone, Craig Stinson, M. David Stone, Ethan Winer

Associate Art Directors Heidi Antman, Charles Conover, Donna Panagakos, Lisa A. Sergi **Assistant Graphics Director** David Foster **Graphic Artists** Robin L. Malik, Josef Pusedu **Assistant to the Art Director** Frieda T. Smallwood

Technical Directors Rick Ayre (Software), Nick Stam (Hardware) **Project Leaders** Richard Brady (Networking and Communications), Ben Z. Gottesman (Software), Jonathan Hill (PCs), Jeff Mace (Graphics), Stephen W. Plain (Applications Development), Michael J. Zulich (Hardware) **Senior Programmer** Stuart R. Greenberg **Programmer** Richard V. Dragan **Product Testing Manager** Charles Rodriguez **Technical Analysts** Mario Baldasserini, Jimmy Beltran, Richard Fisco, Margaret A. Piemonte, Amarendra Singh **Support Technicians** Thomas M. Amoroso, Paul Y. Chin, Corey A. Cooley, Laura Cox, William P. Flanagan, Constantine Fotopoulos, Dan Smith **Operations Manager** John R. Delaney **Inventory Control Coordinators** Peter Bastide, Rob Graydon, John Jones **Administrative Assistant** Angela M. Collins

Publisher Jeff Ballowe

Associate Publishers Anna Zornosa (West Coast), Daniel Rosensweig, Michael Perkowski (Marketing) **Advertising Director, East Coast** Lon Otremba **Promotion Manager** Stacy O'Connell **Publishing Services Manager** Bill Stephen **Client Services Managers** Mark Malloy (Direct Marketing), Michael Wiener (Networking), Steve Robinson (Systems) **Creative Services Manager** John Wisdom **Research Director** Michael Van Engen **Research Associate** Theresa McKenty **Special Projects Director** Karla Spormann **Assistant Events Manager** Dawn Gudelis

Senior Advertising Production Manager Lori Iaccino **Advertising Production Manager** Pamela Berkowitz **Assistant Advertising Production Managers** Susan Conrad, Allen Grady **Editorial Production Coordinators** Kevin S. Fagan, Jo-Ann Hirschel

Advertising Office: One Park Ave., New York, NY 10016-5802; 800 33 MAG AD, 212-503-5100

Ziff-Davis Publishing Company
Chairman and CEO Eric Hippeau
President J. Scott Briggs
Executive Vice Presidents Ronni Sonnenberg, Mike Edelhart
Group Vice President J. Samuel Huey
Group Vice President, Direct Publications Jim Stafford
Senior Vice President, Marketing Paul H. Chook
Senior Vice President Rachel Greenfield
Senior Vice President, International Development J.B. Holston III
Vice President & General Manager Louis B. Dotti, Jr.

Vice Presidents Baird Davis (Operations), Howard D. Sckolnik (Controller), Herbert Stern (Creative Services), Rolf Wulfsberg (Research), James F. Ramaley (Circulation Services), Ann Pollak Adelman (Marketing Services), Roger Herrmann (Production), Frank Kelcz (Europe), William B. Machrone (Technology), Paul Stafford (Central Advertising Sales), Marian O. White (ZD Magazine Networks), Rayna Brown (Human Resources), Claude P. Sheer **Executive Director, Information Systems** John Helliwell **National Managing Director, Magazine Networks** Joseph Gillespie **Directors** Jean Lamensdorf (Licensing), Gary A. Gustafson (Planning), Walter J. Terlecki (Production), Dan Leonetti (Sales Training), Susan Delman (Corporate Marketing), Lewis D'Vorkin (Editorial Director), Alicia Marie Ivans (Direct Marketing Programs), Gregory M. Jarboe (Public Relations) **Business Manager, Publishing Operations** Tom McGrade

Ziff Communications Company
Chairman William B. Ziff, Jr.
President Philip B. Korsant
Executive Vice President Philip Sine
Senior Vice President Steven C. Feinman
Vice President, General Counsel, and Secretary J. Malcolm Morris
Vice President, Controller, and Treasurer Patrick J. Burke, Jr.
Vice President Seth R. Alpert
Vice President, Business Manager T.L. Thompson
Vice President, Chief Information Officer Thor Olson
Vice President, Electronic Editorial Director Michael Kolowich
Vice President of Market Development Robert G. Brown

Subscription Inquiries, Address Changes

Subscription Services: For subscription service questions, address changes, or ordering information, call toll-free 800-289-0429 in the U.S. and Canada; all other countries, please contact Ireland: 353-61411466 or fax 353-61419457. Or write to *PC Magazine*, P.O. Box 54093, Boulder, CO 80322-4093.

Subscription Rate: The subscription rate is $44.97 for a one-year subscription (22 issues). Canada and all other countries, please add an additional $32.00 for postage. GST Registration Number: R-123669673.

Back Issues: For back issues (subject to availability), $8 per issue ($9 outside the U.S.), send check or money order to Back Issues Dept., Ziff-Davis Publishing Company, P.O. Box 53131, Boulder, CO 80322-3131.

How to Contact the Editors

We welcome letters. However, we cannot look up stories from past issues, recommend products, or diagnose problems with your PC by phone. Send your written questions, complaints, and compliments to *PC Magazine*, One Park Avenue, New York, NY 10016-5802. Please include a daytime telephone number. Send electronic mail to MCI Mailbox 157-9301 or to PC MagNet (see below). *PC Magazine*'s general number is 212-503-5255. The West Coast Operations number is 415-378-5500.

If you are dissatisfied with a product advertised in *PC Magazine* and cannot resolve the problem with the vendor, write (do not call) Jennifer Roth, Advertising Department, at the above address. Include copies of your correspondence with the vendor.

PC Magazine does not accept unsolicited manuscripts. We will pay $50 for Solutions and Programming user tips and for Abort, Retry, Fail? submissions. If you submit artwork or newspaper clippings with Abort, Retry, Fail?, mark up the photocopy, not the original.

PC MagNet

PC Magazine operates PC MagNet, an on-line service of ZiffNet, hosted by CompuServe. To join, set your communications software for 300, 1,200, 2,400, or 9,600 bits per second (bps), 7 data bits, even parity, 1 stop bit, and full duplex. To find the number nearest you, dial 800-346-3247. (In Canada, dial 800-635-6225, voice only.) When the modem connects, press Enter. At the Host Name prompt, enter PHONES. Follow the menus, note the number closest to you, then hang up and dial the number you have just found.

To obtain the utility without ZiffNet connect charges, at the HOST NAME prompt, enter CIS. At the USER ID prompt, enter 60116,1. At the PASSWORD prompt, enter PCMAGUTIL. To join ZiffNet, at the Host Name prompt, enter CIS. At the USER ID prompt, enter 177000,5000. Enter PC*MAGNET at the PASSWORD prompt and Z11D9200 at the ENTER AGREEMENT NUMBER prompt. CompuServe members may join by typing GO PCMAG at any CIS prompt. For Customer Service, call 800-848-8990. ZiffNet membership is $2.50 a month, which includes access to *PC Magazine* Editors' Choice Awards, Product Reviews Index, weekly news from *PC Week*, Buyers' Market, and ZiffNet Highlights and Information. Hourly connect charges are $6.30 for 300 bps, $12.80 for 1,200 or 2,400 bps, or $22.80 for 9,600 bps.

Permissions, Reprints

Material in this publication may not be reproduced in any form without permission. If you want to quote from an article or use *PC Magazine*'s logo in conjunction with an Editors' Choice designation, write Chantal Lavelanet; for information on reprints in quantities of 500 or more, write Claudia Crichlow.

PC Magazine Reviews

Except where noted: All *PC Magazine* reviews are of currently available products. Benchmark and performance tests are run on Compaq Deskpro 386/25s and 25c's.

Editorial and Business Office: One Park Ave., New York, NY 10016-5802. Editorial: 212-503-5255, Advertising: 800 33 MAG AD, 212-503-5100. *PC Magazine* is an independent journal, not affiliated in any way with International Business Machines Corp. IBM is a registered trademark of International Business Machines Corp. Entire contents copyright ©1993 Ziff-Davis Publishing Company, a division of Ziff Communications Company. All rights reserved; reproduction in whole or in part without permission is prohibited. The following are registered trademarks of Ziff Communications Company: PC, *PC Magazine*, PC Labs, PC MagNet, PC Magazine Award for Technical Excellence, PC Magazine Editors' Choice Award. The following are trademarks of Ziff Communications Company: Abort, Retry, Fail?; Connectivity; Databases; Direct Marketing Connection; First Looks; New and Improved; Advisor; Lab Notes; PC Marketplace; Pipeline; Trends; Tutor; The PC Utilities, Power Programming, Power User; Read Only; Spreadsheets; User-to-User; The Working Word.

Printed in the U.S.A.

BPA The Audit Bureau

First, we'll try muscle.

Then, we'll reason with you.

AUSTIN

A powerful argument for Austin.

$1495

Austin 486 VESA Local Bus Systems at new low prices.

Austin gives you VESA local bus video at a price below the competition's ordinary systems! Our 486 systems have high performance VL-Bus video boards with bit blitting, hardware cursor, line drawing engine and polygon fill to make Windows display with lightning speed. And that's just the beginning:

intel inside

486/SX-25 WinStation
4MB of Memory, 128K Cache, 170MB Hard Drive, Two Floppy Drives, Super VGA Monitor, Upgradeable CPU, PFS Windows Works – **Only $1495**

486/DX-33 VESA-LB WinStation
$1795
- 1MB VL-Bus Windows Accelerator
- 4MB Memory
- 128K Cache
- 170MB Hard Drive
- 14" NI Super VGA Monitor
- Upgradeable CPU
- PFS Windows Works

486DX2-50 VESA-LB WinStation
$2395
- 1MB VL-Bus Dxl. Windows Accelerator
- 8MB Memory
- 256K Cache
- 170MB Hard Drive
- 14" NI Super VGA Monitor
- ZIF CPU Socket For Easy Upgrades
- Two VESA Local Bus Slots
- Choice of Application Software

486/DX2-66 VESA-LB WinStation
$2995
- 1MB VL-Bus Dxl. Windows Accelerator
- 8MB Memory
- 256K Cache
- 340MB Hard Drive
- 15" NI Super VGA Monitor
- ZIF CPU Socket
- Two VESA Local Bus Slots
- Choice of Application Software

ALL SYSTEMS INCLUDE THE FOLLOWING UNLESS NOTED:

1.44MB & 1.2MB Floppy Drives • 101-Key Keyboard, Microsoft Mouse • Small Footprint Chassis
Pre-Installed MS DOS 5.0 & Windows 3.1 • McAfee AntiVirus Software

A U S

Now, a more reasonable approach.

REASON #1
AWARD-WINNING MACHINES.

REASON #2
WE'VE PROVEN OURSELVES FOR OVER 8 YEARS.

REASON #3
COMPLETE NETWORK SOLUTIONS AND SUPPORT.

REASON #4
QUALITY ASSURED!
30-DAY MONEY BACK GUARANTEE.

REASON #5
YOUR SYSTEM ARRIVES READY TO RUN.

REASON #6
TOP-NOTCH COMPONENTS.

REASON #7
GE™ ON-SITE SERVICE.

REASON #8
OUTSTANDING TECHNICAL SUPPORT, 7 DAYS A WEEK.

REASON #9
RATED #1 IN SERVICE AND SUPPORT BY PC WORLD.

Network Sales Division
1(800)874-7182

AUSTIN
COMPUTER SYSTEMS
AN IPC COMPANY

CALL FOR OUR LATEST TELEPHONE SPECIALS!

For Information on IPC America's Point of Sale Systems, Call 1(800)767-8376

Network Sales Division 1(800)874-7182
Government 1 (800) 833-4472
GSA #GS00K91AGS-5201-PS01
Canada 1 (800) 338-1565
Overseas 1 (512) 339-3500
FAX 1 (512) 454-1357

10300 Metric Blvd., Austin, TX 78758

1(800) 752-1577
ORDER TOLL FREE

WE ACCEPT ACS AND ALL MAJOR CREDIT CARDS -- AND C.O.D.

© 1993 Austin Computer Systems. All Rights Reserved. Other product names or trademarks shown herein are for illustrative purposes only and may be the property of other companies. Prices listed are this month's specials only, and not the list price. Prices and specifications are subject to change without notice. Austin Computer Systems cannot be responsible for errors in typography or photography. There is no annual fee or minimum charge required for the Austin Computer Systems credit card and the annual percentage rate is 17.88%. Intel Inside trademark logo is a trademark of Intel Corp. Microsoft is a registered trademark and Windows and the Windows logo are trademarks of Microsoft Corp.

CIRCLE 012 ON READER SERVICE CARD

Feel The Information.

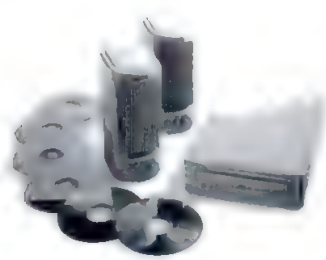
It's all around you. See it, hear it, watch it move, all at the same time. With the Desktop Library, a complete CD-ROM multimedia kit for your PC.

It's a learning tool that lets you hear the music as you read about the composer, witness historic events in video clips and stereo sound, and explore some of the great wonders of the world.

It's also a valuable business tool, giving you access to thousands of CD-ROM titles, from census data to medical journals.

A complete Desktop Library kit comes with CD-ROM player, stereo speakers, sound board, and a collection of utilities, applications, and multimedia titles on six CD-ROM discs.

Everything you need to turn information into an experience. Call 1-800-352-7669, ext. 100.



Sony Desktop Library

©1992 Sony Corporation of America. All rights reserved. Sony and Desktop Library are trademarks of Sony. Complete external drive Desktop Library kit featured.

CIRCLE 071 ON READER SERVICE CARD

According to Mr. Magoo, there's no trick to spotting a reliable monitor. You just pick one from a manufacturer that has met the stringent ISO 9000 series of standards for quality. And displays the ISO 9000 seal. The way Samtron does.

In fact, Samtron was awarded ISO's highest rating: ISO 9001. One of the very few monitor manufacturers in the world to ever earn it.

To achieve that rating, we underwent 1½ grueling years of auditing ordered by the Geneva-based International Organization for Standards (ISO). Everything we do was scrutinized. From design and manufacturing through packing and shipping.

Their high rating means that, with the possible exception of advertising, they approve of what Samtron does. The way we train our people. The way we keep our records. Our management. Our delivery. Our overall product quality. About the only thing they weren't quite sure of was Magoo.

Gads, Two New Flat-Screen Monitors. With our world-class ISO credentials clutched in hand, we present our new high resolution flat- screen, color monitors. The SC-528DX multi- mode 15". And the SC-726V, our 17" with 0.26 dot pitch. These monitors have pictures so big and so sharp that even Mr. Magoo's eyes can see them. All the way out to the corners. Without distortion. Which makes them ideal for viewing Windows™ or CAD/ CAM. If your needs are smaller look at our 14" EagleEye™ color monitor SC-428TX. With 0.28 dot pitch and 1024 x 768 non-interlaced resolution. They're all monitors worth looking into.

Even Mr. Magoo can see that.

Along with our ISO 9001 rating, Samtron's picture tubes, with the Mr. Magoo-seal of approval, separates the leader in monitor technology from all the rest.

WE'RE WORTH WATCHING

SAMTRON

CIRCLE 296 ON READER SERVICE CARD

Letters

AREN'T YOU FORGETTING SOMETHING?

In "DOS 6 to Double Hard Disks" (Trends, January 12, 1993), nearly a full page is spent rhapsodizing over how great MS-DOS 6.0 will be with its on-the-fly disk compression and decompression.

It's amusing that Digital Research's DR DOS 6.0 was not mentioned once, considering it has had this capability for nearly a year! In fact, DR DOS 6.0 has all the other "new" utilities MS-DOS 6.0 offers except for virus-checking, but that will probably be included in DR DOS 7.0. Also, if past trends are a guide, it may even be available before MS DOS 6.0.

William Degler
Wheeling, Illinois

THUMBS UP, THUMBS DOWN?

The "1992 Thumbs Up/Thumbs Down" section in "The Best of 1992" (January 12, 1993), contained several factual errors regarding Intergraph Corp.'s MicroStation PC.

First of all, MicroStation is not a new product; it was introduced in 1987 and has been the second-best-selling PC CAD package since 1988.

Also, the package you tested did not bomb every 30 minutes, it timed out. If the hardware lock is missing or unrecognized, MicroStation runs in demonstration mode. In this mode, the software completes the operation and won't accept the next command, leaving all files intact.

The apparent bug in the interface could have resulted from a number of causes, not just from the parallel-port dongle. Intergraph is looking into the specifics of this configuration in order to replicate the incident and respond to it.

John Hubbard, Manager
MicroStation Marketing
Intergraph Corp.
Huntsville, Alabama

PC Magazine unjustly gave a "Thumbs Down" to the entire PC industry for failing to agree on a standard for CD-ROMs.

CD-I, CD-ROM XA, CDTV, MPC, Ultimedia, and VIS are actually all multimedia derivatives of CD-ROM. Once the flash and glitter of multimedia began to get widespread attention, developers like IBM, Kodak, Microsoft, Sony, and Tandy tried to grab the lion's share of the home market by introducing proprietary standards. To condemn CD-ROM technology for the incompatibilities of multimedia platforms is not only unfair, but it is also inaccurate.

CD-ROM is the most standardized medium in the industry. The physical standard is called Yellow Book. Any disk manufactured to this standard is readable in any manufacturer's drive. Also, disks recorded in the ISO 9660 format are accessible by Macs, PCs, and Unix-based systems. Show me another technology that can make these claims.

Dana J. Parker
New York, New York

Trends

DOS 6 to Double Hard Disks

Mixing Up Laptop Batteries

Video for Windows Spawns Hardware

"Microsoft adds features to MS-DOS 6.0 that are already in DR DOS 6.0."

NO PROBLEMS HERE

Thank you for giving us one more reason to avoid Windows. In "Got the Travellin' Font Blues" (Pipeline, January 26, 1992), you say how difficult it is to share or distribute documents and files created with Windows applications because Windows does a poor job of font-substitution when files are moved between systems with different typefaces installed.

WordPerfect for DOS is used exclusively at our office and has done a marvelous job translating forms, fonts, and formats in our environment. We are continually moving and sharing files between users with different font packages, printing on a myriad of printers with varying levels of font support, and faxing files on assorted fax devices with various emulation capabilities. If we had problems like the ones you describe. I think I would just retire.

Joshua W. Wertheim
New York, New York

PORTABLE COMMUNICATORS: BANE OR BLESSING?

I would like to comment on John C. Dvorak's "Privacy, Schmivacy" (January 26, 1992). Although portable telecommunications devices may seem perfect for workaholics and power-mad bosses, the majority of individuals with these devices wind up chaining themselves to their work. The benefits of this technology should ease the difficult task of balancing professional and family life, not make it harder.

Therefore, instead of dumping all the devices as Mr. Dvorak suggests, I think people should just find the ON/OFF switches on their portable communicators and learn how to use them.

Dmitry A. Altshuller
Chesterfield, Missouri

John C. Dvorak's comments on portable communication devices were excellent. Why must we add E-mail pagers to our belts? Aren't we already overfeeding on bizarre and useless information?

David Hagan
San Diego, California

AND THE WINNER IS...

Hooray! OS/2 2.0 is *PC Magazine*'s operating system winner in "The 9th Annual Technical Excellence Awards" (December 22, 1992). But when you think about it, there really wasn't any competition. DOS is old and needs a lot of memory-management band-aids, Windows is just a graphical environment, and Win-

Only an AST *engineer* would choose *200* MEGABYTES *over their* 1200cc V-*Twin.*

As you can see, our employees are a passionate lot. Who else would give up (voluntarily, mind you) a day on the open road to spend it, instead, glued to a new systemboard design? And the results of this passion? Look no further than the AST PowerExec.™ A notebook that actually adapts to the work habits of the user–powering down selected functions between keystrokes and other periods of system inactivity. The power saved can then be used to upgrade the PowerExec in ways previously only seen in desktops. We call it Intelligent Power Management, and it's just one of the breakthroughs that's made us a *Fortune 500* firm with sales over $1 billion. Proof that when you'd rather hover over a keyboard than a set of handlebars, anything can happen.

Discover how our obsession can meet your PC needs. Call 800-876-4AST.

AST COMPUTER

The Product Of Our Obsession.

© 1992 AST Research, Inc. AST, AST logo are registered trademarks and PowerExec is a trademark of AST Research, Inc.

POWEREXEC

SMART

Intel 386SL/25 or 486SL/25 microprocessor, with AST Intelligent Power Management.

POWERFUL

4MB of RAM, 64KB cache

FLEXIBLE

Flash BIOS, Removable Hard Drive, Docking Stations, Security Locks

VERSATILE

Two credit-card-sized, industry-standard PCMCIA slots for simultaneous connectivity to networks, modems, faxes and other peripherals

UPGRADABLE

To Intel 486SL (32-bit, 3.3-volt) processor. Removable Hard Drives to 200MB, RAM expansion to 20MB, optional passive and active color displays

RESPONSIVE

To learn more, call 800-876-4AST (4278). We'll answer your questions right away.

FAST

1958 Harley Davidson Duo-Glide Panhead. 1200cc V-Twin with swingarm frame Optional, of course.

The Intel Inside Logo is a registered trademark of Intel Corporation. Fortune 500 is a registered trademark of the Time Inc. Magazine Company.

LETTERS

dows NT is not yet available.

Now that OS/2 has won, maybe we'll see more performance comparisons between OS/2 and Windows applications.

Steven Hoagland
Asheville, North Carolina

WHAT ABOUT US?

I was disappointed by "LAN Packages Distribute Apps" (Trends, January 12, 1993). Until recently, Aleph Systems' WINSTALL was almost the only automated means of distributing or removing Windows applications from a network. Now that the software giants are planning to move into this territory, *PC Magazine* has let its readers know of the need for this software, without mentioning our product at all!

The big companies will probably come to dominate this market, but your readers deserve to know that we pioneered this area, while our program has earned the right to be considered alongside those from the Novells and Microsofts of the world.

Mel Raff, President
Aleph Takoma Systems
Takoma Park, Maryland

ADAPTING TO CHANGE

I am a little disappointed with the thoroughness of "Making a Choice in an Era of Change" (January 12, 1992). Your attempt to show the difference between the three main bus architectures was useless because you tested VL-bus cards on a 33-MHz 486 system while testing ISA- and EISA-based cards on a 25-MHz 386. How can you expect your readers to see the anticipated performance advantages of VL-bus technology when their higher numbers could be easily attributed to a faster CPU?

Keith Luken
Marietta, Georgia

While your recent roundup of graphics adapters was an excellent update on state-of-the-art video accelerators, it did a disservice to those of us ready to upgrade by failing to correlate the new Winbench 3.1 scores to the widely published and advertised values produced by video cards tested with Winbench 2.5.

Gary S. Thompson
Indianapolis, Indiana

TOO GOOD TO BE TRUE

Disk compression utilities have really carved out a hefty market niche for themselves. The promise of being able to "double" your available hard disk space for under $100, without having to invest in any new hardware, is almost too tempting to pass up.

Beware! Once compression utilities fill your hard disk beyond its normal capacity, changing or upgrading your existing operating system becomes next to impossible.

But beware! If you're using a compression utility you may be leading your PC down a dead-end street because once your hard disk is filled beyond its normal capacity, changing or upgrading your existing operating system becomes next to impossible.

William H. Christensen
Knoxville, Tennessee

WHY PAY MORE TO PAY TAXES?

It's not paying taxes that gets my goat, it's paying what I feel are exorbitant prices to upgrade my federal and state income tax programs.

Tax software has been pretty stable for the past few years, and everyone I talk to that uses these programs only upgrades each year to keep up with the changing tax codes, not because they want or need the latest technological improvements.

Steve Vanetti
Middletown, New Jersey

FIRE SUPPRESSOR

I am pleased to see that you will reevaluate surge suppressors in early 1993 (Corrections and Amplifications, January 12, 1993). I used to use plastic-housed surge suppressors at home, until they failed with catastrophic consequences. Each one burned a hole through its case and melted the carpet on which it rested. I now only purchase surge suppressors with sturdy metal housings because I believe they are more likely not to start a fire. This time around, please evaluate the fire safety of these products.

Jim Bewley
Littleton, Colorado

MORE INDEXES PLEASE

The PC industry is a growing and fast-changing field. While *PC Magazine* has done a fine job trying to keep its readers informed, I feel that there should be more cumulative product indexes, updated three or four times a year, so readers can easily locate information regarding products they're interested in.

Ralph L. Hyland
Cocoa, Florida

COMPUTER DICTIONARY

Although I am an avid reader of your magazine, I don't by any stretch of the imagination understand all of the vocabulary relating to computers. Unfortunately, it is important to know what "cache," "expansion slot," "ISA," "MCA," and "IDE" mean when trying to make a prudent buying decision. While it's silly to suggest that you print a glossary with every issue, is there anywhere I can get help?

Lee A. Davenport
Towanda, Pennsylvania

• You may want to take a look at the *Microsoft Press Computer Dictionary*, which we reviewed in Read Only (November 12, 1991).—Ed

HOW TO WRITE TO PC MAGAZINE

We welcome your comments and suggestions. Please send correspondence to Letters, *PC Magazine*, One Park Ave., New York, NY 10016-5802, or upload it to PC MagNet (see page 12 for access information). All letters become the property of *PC Magazine* and are subject to editing.

The new PacificPage® PE/XL. Switching to PostScript® has never been easier.

AUTOMATIC POSTSCRIPT AND PCL LANGUAGE SENSING AND SWITCHING.

We want to make your life easier. To do it, we've added autosensing and switching to our latest release of PacificPage® PE/XL for the LaserJet® IIP, IIP Plus, III, IIID, and IIIP. What it does is eliminate the inconvenience associated with manual switching between PostScript and PCL languages. It's especially useful to users of networked LaserJet printers or individuals who send both PostScript and PCL files to their printer. No special software, drivers, PC boards or special cables are required.

PacificPage PE/XL is easy to use, but it's also fast. The accelerator board utilizes an Intel i960 processor for output up to 8 times faster than any other cartridge. And our new automatic interface switching feature allows users to simultaneously use all interface ports.

PacificPage PE/XL includes 35 fully scalable typestyles and is compatible with all Windows and DOS software programs that support PostScript. All you need to do is slip the cartridge and accelerator board into the printer, select the standard PostScript driver, and you're ready to print!

Pacific Data Products offers a full lifetime warranty, free technical support, convenient upgrade programs, and of course, our 60 day money-back guarantee of satisfaction.

Getting all the benefits of PostScript on your LaserJet has never been easier. For more information, call us at (619) 625-3580 or fax (619) 552-0889.

Typestyles:
Courier Swiss 721 (Helv) Swiss 721 Narrow (Helv Narrow)
Dutch 801 (Tms Rmn) Zapf Calligraphic 801 (Palatino)
ITC Avant Garde® ITC Bookman® Century Schoolbook
ITC Zapf Chancery® ITC Zapf Dingbats® ✆✈✐✆ Symbol αβχδ

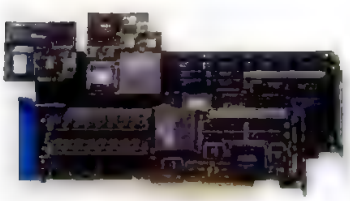
Each typestyle comes in normal, bold, italic and bold italic treatments except for Chancery, Zapf Dingbats, and Symbol.

PACIFIC DATA PRODUCTS

PacificPage is a registered trademark of Pacific Data Products, Inc. PostScript is a registered trademark of Adobe Systems, Inc. LaserJet is a registered trademark of Hewlett Packard Co. i960 is a trademark of Intel Corporation. PhoenixPage is a registered trademark of Phoenix Technologies Ltd. 1987 1988 Phoenix Technologies Ltd. All other trade names referenced are the trademarks or registered trademarks of the respective manufacturer. Pacific Data Products, Inc. 9125 Rehco Road, San Diego, CA 92121 USA. **European Offices:** England Tel 0800 51 5511 Fax 44 442 236540 France Tel 05 90 65 09 Fax 33 1 89 63 20 41 Germany Tel 0130 81 8685, Ireland Tel 353 61 475699 Fax 353 61 475608, Switzerland Tel 41 22 341 26 50 Fax 41 22 341 06 82, Belgium Tel 078 111292, Netherlands Tel 06 0222065. © 1992 Pacific Data Products, Inc.

$3,280

KINGSTON PROCESSOR UPGRADES.



Significant Savings, Equivalent Performance.
Kingston's SX/Now!, 486/Now!, MCMaster, ATMaster and the IBM designed SLC/Now! processor upgrades make existing systems perform like new 386SX, 486SX or 486DX models. They provide the power needed for today's software, perform comparably to new systems and cost at least 50% less.

SX/Now!	IBM-AT	With SX/Now! 25	PS/2 Model 57SX-045
Landmark Speed 2.0:	8 MHz	35 MHz	22 MHz
Recount:	5:44 Min.	1:51 Min.	1:54 Min.
Retail Price:		$215	$1,545
SLC/Now!	**PS/2 Model 50**	**With SLC/Now! 25**	**PS/2 Model 57SX-045**
Landmark Speed 2.0:	13 MHz	33 MHz	22 MHz
Recount:	3:34 Min.	1:08 Min.	1:54 Min.
Retail Price:		$245	$1,545
486/Now!	**PS/2 Model 70-25MHz**	**With 486/Now! SX 25**	**PS/2 Model 90XP 25**
Landmark Speed 2.0:	39 MHz	84 MHz	84 MHz
Recount:	:55 Sec.	:39 Sec.	:38 Sec.
Retail Price:		$495	$3,280
MCMaster	**PS/2 Model 55SX**	**With MCM SX 25**	**PS/2 Model 90XP 25**
Landmark Speed 2.0:	16 MHz	84 MHz	84 MHz
Recount:	2:47 Min.	:36 Sec.	:38 Sec.
Retail Price:		$795	$3,280
ATMaster	**PS/2 Model 40**	**With ATM SX 25**	**PS/2 Model 90XP 25**
Landmark Speed 2.0:	21 MHz	84 MHz	84 MHz
Recount:	1:48 Min.	:45 Sec.	:38 Sec.
Retail Price:		$875	$3,280

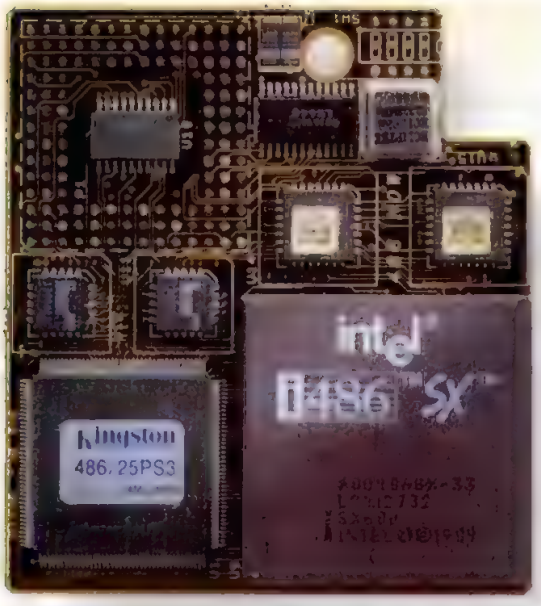
All systems tested with 1MB installed except ATMaster tested with 8MB, and MCMaster tested with 8MB on-board and 8MB on mother board. All system prices are MSRP at standard configuration as of 3/1/93. Processor upgrade prices are MSRP as of 3/1/93. Recount conducted on SMB Excel for Windows spreadsheet generated by Kingston Technology.

Eliminate Peripheral Replacement and Software Reinstallation.
When upgrading with Kingston, existing peripherals will remain fully compatible with host systems. Re-installation of operating system and application software is eliminated.

Systems Supported.
Kingston's SLC/Now! supports IBM's 286-based systems while SX/Now! supports 286-based systems from AST, Compaq, Epson, Hewlett-Packard, Toshiba and Zenith. 486/Now! upgrades 386DX systems from IBM and Compaq. MCMaster supports all IBM PS/2 Micro Channel systems while ATMaster supports 386SX systems from IBM and Compaq.

1992 BYTE AWARD OF MERIT

Leadership in Processor Upgrades.
Kingston is the industry leader in performance and reliability. Byte Magazine's 1992 Award of Merit was presented to MicroMaster, the forerunner of the MCMaster.



$495

SAVE YOUR SYSTEM AND A BUNDLE.

Compatibility is Assured.
Testing with the original manufacturer's diagnostics guarantees 100% hardware and software compatibility. The National Software Testing Laboratory certifies that Kingston's upgrade products are fully compatible.

Both SXNow! and 486Now! are currently certified by The National Software Testing Laboratory. Certification for recent introductions. MCMaster ATMaster and SLCNOW! is pending.

Easy Installation.
MCMaster and ATMaster upgrades install in any available expansion slot. SLC/Now!, SX/Now! and 486/Now! plug directly into the existing processor socket on the mother board. With Kingston's product manuals that detail the simple, step by step installation, it only takes about 10 minutes to complete the process.

Individual Product Testing.
Every product is bench tested in the system for which it was designed. Testing with original equipment manufacturer system diagnostics assures absolute compatibility. This rare commitment to quality control leads to many years of reliable service.

Kingston Reliability.
Processor upgrade users enjoy the same reliability customers have come to expect from Kingston memory products. Every product is individually tested prior to shipping, supported by free comprehensive technical assistance and backed by a five-year warranty. Thanks to this relentless scrutiny, we have over 5,832,717 products hard at work in the world today.

More Information.
To find out which processor upgrade is best for you, contact your nearby Kingston dealer or give us a call at (800) 835-6575. We'll be happy to answer your questions about processor upgrades or any of our other 625 upgrade products.

[800]

Kingston TECHNOLOGY CORPORATION

THE INSIDE NAME IN UPGRADES

17600 Newhope Street, Fountain Valley, California 92708 (714) 435-2600 Fax (714) 435-2699

All Trademarks, Registered Trademarks and Logos are of their respective holders. Kingston and Kingston Technology are Registered Trademarks of Kingston Technology Corporation. MCMaster & ATMaster are Trademarks of Aox, Inc.

CIRCLE 106 ON READER SERVICE CARD

Exactly how fast is graphics performan Image™ Series PCs?

Let's just say we developed Image Video™ technology expressly for all you high-performance speed demons. Fact is, we've engineered our Image™ Series PCs with a powerful combination of our second-generation local bus and graphics accelerator, allowing graphics information to travel directly between the CPU and video memory, so Windows™ is a breeze and you can sprint through today's most demanding graphics applications.

NEC has the ultimate system for graphics applications: lightning-quick Image Series PCs with integrated SCSI II interface, legendary MultiSync FG monitors, and our pioneering CD-ROM readers with MultiSpin™ technology.

Based on Intel's powerful 486 chip, each Image Series PC has OverDrive™ capability for easy processor upgradability. An on-board SCSI II interface means you can quickly connect to a wide variety of peripherals. And with our new OptiBus™ technology, your peripheral performance is up to 30% faster than ordinary systems. We've even made it easier for you to network your PCs with an optional factory-integrated, high-performance 10BaseT Ethernet® adapter.

Plus, every Image Series PC is designed with True Color support of up to 16.8 million colors for photo-realistic images, as well as our exclusive ImageSync™ technology for flawless performance when connected to our award-winning MultiSync® FG™ series monitors. The result? Clear, flicker-free images without any adjusting.

So call 1-800-NEC-INFO (in Canada, 1-800-343-4418), or NEC FastFacts™ at 1-800-366-0476 (# IMAGE). Then hold on to your spots.

Because ⬆ is the way you want to go.

NEC

MultiSync is a registered trademark and FG, Image, Image Video, ImageSync, OptiBus, MultiSpin and FastFacts are trademarks of NEC Technologies, Inc. The Intel Inside logo is a registered trademark of Intel Corp. All other trademarks or registered trademarks are the property of their respective holders. NEC CSA #CS00CB31AQ05241 © 1995 NEC Technologies, Inc.

CIRCLE 157 ON READER SERVICE CARD

the

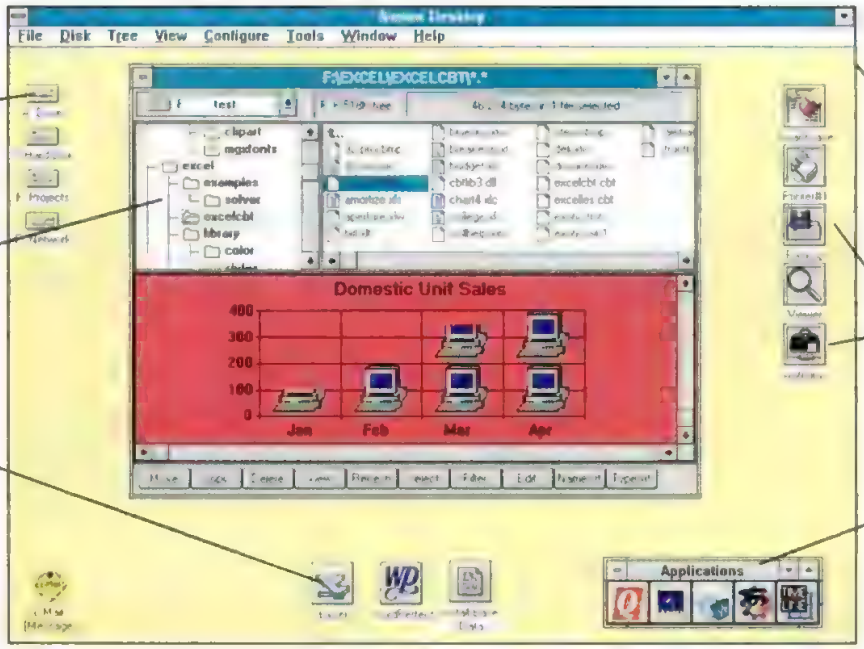
ce of NEC's

NORTON DESKTOP FOR WINDOWS SAVES TIME, MONEY, ENERGY, AND DATA.

With Norton Desktop for Windows, your drive icons sit right on the desktop, so you get direct access to your files.

Click on a drive icon for easy file management. The drive window includes a tree pane, file pane, and a customizable button bar with a view option.

For total convenience, applications or files can be dragged onto the desktop for easy access. Open files effortlessly with a quick mouse click or, by dragging the file to the application.



The Norton Desktop is a completely integrated [illegible]. You can drag and drop files from the drive window to a tool, drive icon, application, or onto the desktop itself.

All the utilities you need to backup, protect, and repair your data sit right on your desktop. You can drag files or drive icons directly to the tool you need.

Insert your favorite applications in a handy customizable toolbox. Launch the application easily with just a click of the mouse.

That's a package full of savings. Norton Desktop for Windows 2.0 enhances Windows in all the important ways. It helps you work faster, smarter, and with better results.

Saves Time.

Something you don't have a lot of. We've improved file management, placing drive icons right on the desktop, so you get immediate access to all your files and applications. Speed search, button bar, viewer, customizable fonts, and collapsible tree structure are all designed to save you time. Full drag-and-drop allows you to drag applications and files out of the drive window to anywhere on the desktop so you have instant access to them.

Saves Money.

We all know time is money. And because Norton Desktop looks so much like Windows, you won't have to waste time learning how to use it. You get most everything you need to run your PC in one comprehensive package — a great, money-saving value.

PC MAGAZINE EDITORS' CHOICE
September 29, 1992
Norton Desktop for Windows 2.0

Saves Energy.

Because Norton Desktop can be easily customized, you invest your energy in your work, not in trying to figure out how to get it done. Customizable auto-load frees you from reloading applications that you use daily. And, SuperFind™ allows you to locate "lost" files, across networks or in the background.

Saves Data.

Lost or corrupted data can cost you time, money, and energy. The selection of utilities in Norton Desktop helps you maintain your data. Virus protection and repair, automatic backup, and data recovery can be easily accessed from the desktop; or, scheduled to run unattended, or in the background. Plus, they support all major networks. Norton Desktop for Windows 2.0 is just $179.00 (S.R.P.) at your dealer. Or, call **1-800-554-4403** for an instant FAX Data Sheet (enter 450).** The sooner you get it the sooner you'll save.

SYMANTEC.

© 1992 Symantec Corporation. * Price in U.S. dollars ** For information in Canada, call 1-800-465-2266. In Europe, call 31-71-353111. In Australia, call 612-879-6577. Everywhere else, call 408-252-3570. All trademarks or registered trademarks are those of their respective holders.

CIRCLE 350 ON READER SERVICE CARD

PDA Players Partner Up

Apple spin-off latest to announce a PDA.

General Magic, a company whose product plans have been cloaked in secrecy—is the latest company to announce plans to develop a personal digital assistant. While no specific hardware details were released, General Magic described its product as a Personal Intelligent Communicator, or PIC. Using system software called Magic Cap (Cap is an acronym for communication application platform) and an object-oriented programming language called Telescript, General Magic is targeting communications-based applications.

Telescript is described by General Magic officials as being to communications applications what the Macintosh is to graphics applications. A key function of Telescript is smart messaging. A Telescript message envelope will contain information about the message inside, and will have built-in intelligence to help it locate the recipient. Applications developed for General Magic's PIC will be able to deal with wired, wireless, and fax technologies.

Collaborating with Apple, AT&T, Matsushita, Motorola, Philips, and Sony, General Magic was spun off from Apple when Apple decided to go with the Newton PDA technology rather than the General Magic PIC concept.

General Magic chose its partners carefully. Motorola, which is steeped in technology, is contributing wireless and microprocessor technologies. AT&T has the communications expertise with its EasyLink

Continues on page 32

PDA Partnerships

Designing a PDA takes expertise in several different technologies—microprocessor, communications, display, and miniaturization, for example—so it's no surprise that this also takes several partners.

Tiny Wires May Mean Tiny PCs

RESEARCH SCIENTISTS WORKING at NEC Corp.'s Tsukubu Basic Research Laboratories in Tokyo have developed a new technique for inserting metal into the hollow center of carbon nanotubes, creating what they believe are the world's tiniest wires (with a diameter the width of several atoms, or less than 1.5 nanometers, and lengths up to 30 nanometers). The company hopes that the wires, which are thousands of times smaller than today's wires, can be used to create smaller electronic circuits.

According to NEC, in November of 1991, a company scientist named Dr. Sumio Iijima discovered carbon nanotubes (also known as buckytubes) while he was experimenting with buckyballs (carbon structures named for their resemblance to R. Buckminster Fuller's geodesic domes). Last July, NEC scientists Dr. Thomas Ebbesen and Dr. Pulickel Ajayan announced a simple method for inserting lead into the nanotubes by evaporating it onto a grid of nanotubes and then heating the material for half an hour at a temperature higher than the melting point of lead.

NEC scientists are still exploring the new material, which may be a "nano-composite" with properties different from pure carbon or pure lead. NEC hopes the wires will one day be used in semiconductors, "therefore creating smaller, lighter, and more powerful components for use in PCs," says Ajayan. "If the nanowires are found to be good conductors of electricity, there may be an even greater impact on the PC."

—Mary Kathleen Flynn

Win NT Spawns SMP Systems

MICROSOFT WON'T SHIP WINDOWS NT until later this year, but nearly a dozen computer makers have already delivered machines that have been designed specifically for the 32-bit operating system. Software developers stand to gain the most mile-

Pipeline *By Robin Raskin*

Managing Memory

Although utilities vendors are putting on their best "business-as-usual" veneers, there's no doubt that MS-DOS 6.0 is going to shake things up. With compression, antivirus, and backup utilities built into the operating system, third-party vendors are going to be working overtime to seize any window of opportunity. The pressure is already being keenly felt by the memory management software vendors.

It's not that DOS 6.0's new MemMaker is so good. It's just that it's good enough to satisfy a majority of typical PC users who realize they need to use upper memory to cope with CD-ROMs, fax modems, and other emerging facts of PC life. The challenge is for third-party memory managers to be not just marginally better, but light years better than DOS 6.0.

DOS 5.0's memory optimization was manual; we all learned to type LOADHI. DOS 6.0's MemMaker automates the routine, analyzing the CONFIG.SYS file and automatically detecting what can be loaded high. From beta tests, it also appears that DOS 6.0 will be safely conservative in how it uses upper memory. DOS 6.0 will not perform some of the more dangerous acrobatics used to recover memory, such as loading items in unused BIOS regions or prying into subsidiary batch files. Nor will it do much reordering of the elements that get loaded high—something third-party vendors jockey with to fill each and every available kilobyte optimally.

One of the most ambitious plans for leapfrogging DOS 6.0 comes from Helix Software's Netroom 3.0. This new release offers *cloaking* technology. Cloaking moves Helix's special, customized versions of the PC BIOS, Video BIOS, screen saver, disk cache, RAM Disk, screen accelerator, and other utilities out of conventional memory to extended memory, where they'll exist in a full 32-bit protected-mode environment. The technique is similar to Microsoft's VxD environment, and the utilities are housed in the faster-running, totally privileged Ring Zero address space. The Netroom BIOS is a customized Award BIOS available in four different flavors: EISA, ISA, MCA, and APM. Furthermore, the Cloaking API is included in the box, which means developers can produce 32-bit applications, drivers, and TSRs that use virtually no conventional memory.

Qualitas is more tight-lipped about its plans, but we know the memory management maker sees a veritable goldmine in the new DOS 6.0 footprint. Qualitas expects that the current version of 386MAX will outdo DOS 6.0, claiming anywhere from 30K to 90K more conventional memory and 10K to 60K of high DOS memory. For future versions, Qualitas is working to fill some gaps in the DOS 6.0 implementation, most notably how it works with Windows. It's likely that the new version will be able to reclaim more memory for DOS sessions under Windows.

DOS 6.0 will ask us to redefine our computer personalities. Those satisfied with substantial, but not staggering, memory gains after optimizing their systems will be happy. Those willing to spend a few extra dollars and a smidgeon of extra time will find some interesting products and prospects in the very near future.

Robin Raskin is an executive editor of PC Magazine.

age from these early arrivals.

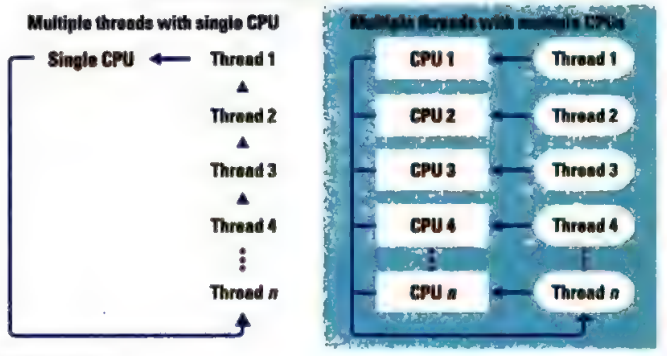
To run NT, a PC has to have a 386 (or more powerful) CPU, 8MB RAM, and a 100MB (or larger) hard disk. But NT-specific systems, such as the multiprocessing ones being sold today, take advantage of particular operating system functions, such as NT's thread-level support for symmetric multiprocessing.

SMP allows multiple CPUs in a single system to share the processing load—a key capability for multitasking and for multithreaded applications such as database servers. Applications don't have to know whether or not the system has multiple processors because the Windows NT Scheduler manages the multiple threads. It sends the highest-priority thread to the next available processor, whether the system has 1 CPU or 16. More processors add up to more efficiency.

The current batch of NT-specific SMP machines relies on 486 chips. But Compaq claims its systems are "Pentium-ready." And desktop SMP systems using Intel's forthcoming Pentium processors—as well as high-end systems based on RISC chips from Digital Equipment Corp. and MIPS Computer Systems—will come out later this year.

With support for 2 to 16 processors and with prices ranging from $8,000 to $1 million, the shipping SMP systems are designed for a wide variety of uses, ranging from high-end desktop workstations to enterprise-wide applications servers. They also come from a broad range of PC and minicomputer makers: Acer, ALR, AST Research, Compaq, Corollary, NCR, Olivetti, Sequent Computer Systems, Tricord, and Wyse.

Symmetric Multiprocessing



Source: Microsoft.

The Windows NT Scheduler sends the highest-priority thread to the next available processor, whether the system has 1 CPU or 16.

Why would anyone want an NT system now while the operating system is still in beta? "Software developers want to get a head start on testing their apps in a multiprocessed system," says George White, president of Corollary, which is selling a three-processor system to developers for $15,000. "You don't have to wait for multiprocessor machines based on RISC chips to work with NT."

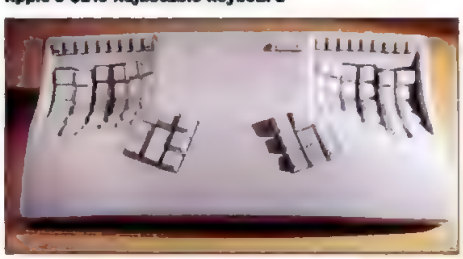
Now all that's missing is a shipping version of Windows NT. Latest reports indicate that a summer product launch is likely.

—Mary Kathleen Flynn

Keyboards Split

A FEW YEARS AGO, CUSTOMER concerns about the health hazards of high-tech devices pressured monitor makers into delivering displays with reduced radiation emissions. This year, users' worries about carpal tunnel syndrome—underscored by a spate of highly publicized lawsuits—have pushed keyboard vendors onto the ergonomically correct bandwagon. Separating the keyboard into two adjustable halves has quickly become the most popular way to cope with cramped fingers.

Apple's $219 Adjustable Keyboard



Kinesis Corp.'s $690 Ergonomic Keyboard

Health Care's $675 Comfort Keyboard System

Apple Computer is the biggest player to embrace the new order. While Apple is careful not to claim its new $219 Adjustable Keyboard reduces the risk of carpal tunnel syndrome and related injuries, the company is touting the ergonomic design and customizability of the device. The keyboard is divided into two hinged sections; so, the theory goes, users can find the angle that is best for them. The slope and height can also be adjusted, and detachable palm rests are designed to reduce stress on the neck and shoulder muscles. The 111-key keyboard comes with a keypad.

Apple has also brought out a new $79 mouse with an elongated, rounded shape to better fit the hand. To date, Apple's new input devices work only with Macintosh machines, but the company is considering a PC version of the keyboard.

Apple is not alone in separating the right and left halves of the keyboard. (In fact, inventor Tony Hodges claims Apple's Adjustable Keyboard infringes on the patent for his Tony! keyboard.) Several lesser-known companies have also brought out split keyboards, most recently Health Care Keyboard Co. (414-253-4131) and Kinesis Corp (206-455-9220).

Health Care's expensive $675 Comfort Keyboard System, which uses the standard 101-key QWERTY layout, is divided into three sections: left-hand, right-hand, and numeric keypad. Each section can be rotated and tilted independently, providing a wide range of positions. The keyboard comes with arm rests.

Kinesis Corp. has taken a slightly different tack. The company's pricey $690 Ergonomic Keyboard (reviewed in First Looks, this issue) separates the left and right halves into two concave keywells, which, the company claims, conform to the shape of the body. The key layout is based on the QWERTY design, but there are innovations—such as thumb keys for the Enter key and the Spacebar—that take some getting used to. Optional foot pedals are also offered to "redistribute the workload."

Whether or not these new keyboard designs cut down on the number of injuries, users have gained a wider range of choices in keyboard comfort. Later this year, you'll see more choices—and even more attention paid to the ergonomics of input devices.

—Mary Kathleen Flynn

Photographs by Thom O'Connor

MRCI Beaucoup Or Habeas Corpus?

ONE OF THE MOST COMPELLING reasons to buy the next version of MS-DOS will be its compression software. Like Stacker and SuperStor (which is bundled with DR DOS 6.0), Microsoft's DoubleSpace disk compression software will effectively double the capacity of a hard disk. (Trends, January 12, 1993.) In fact, it's so much like Stacker that Stac Electronics is suing Microsoft for patent infringement.

While all three compression products are adequate, Microsoft is using its market-leading influence to establish its compression technique, called Microsoft Real-time Compression Format (MRCF), as a standard by releasing the file format and compression API. The API, called MRCI (for Microsoft Real-Time Compression Interface and pronounced *merci*), will let third-party hardware and software companies develop products that work directly with DoubleSpace compressed drives.

Take defraggers as an example. All three leading disk-compression products come with proprietary defragging utilities that optimize a compressed disk. Third-party defraggers won't destroy a compressed disk but don't often enhance it. By writing to the MRCI API, utilities will be able to deter-

Top Retail Software

Current rank no.	Last issue	Product/company
1	11	**TurboTax** *ChipSoft*
2	13	**WordPerfect 5.2 for Windows** *WordPerfect Corp.*
3	1	**Quicken for Windows 2.0** *Intuit*
4	—	**Microsoft Windows 3.1** *Microsoft Corp.*
5	3	**Microsoft Access** *Microsoft Corp.*
6	—	**Fastback Plus 3.1** *Fifth Generation Systems*
7	5	**Quicken 6.0** *Intuit*
8	12	**Microsoft DOS 5.0 Upgrade Kit** *Microsoft Corp.*
9	2	**QEMM-386 6.0** *Quarterdeck Office Systems*
10	10	**WordPerfect 5.1 for Windows** *WordPerfect Corp.*
11	4	**Stacker 3.0** *Stac Electronics*
12	9	**Microsoft Office for Windows 3.0** *Microsoft Corp.*
13	8	**Microsoft Windows 3.1 Upgrade** *Microsoft Corp.*
14	—	**Procomm Plus for Windows** *Datastorm Technologies*
15	—	**WordPerfect 5.2 for Windows Upgrade** *WordPerfect Corp.*

The list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending January 16, 1993. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market. Sales information compiled by Ingram-Micro.

mine if a disk is MRCF-compressed, at which point it can take the appropriate action. As a result, there will no longer be the fear of incompatible software, and with competition, third-party compatible utilities should be faster and produce more tightly compressed disks than proprietary solutions.

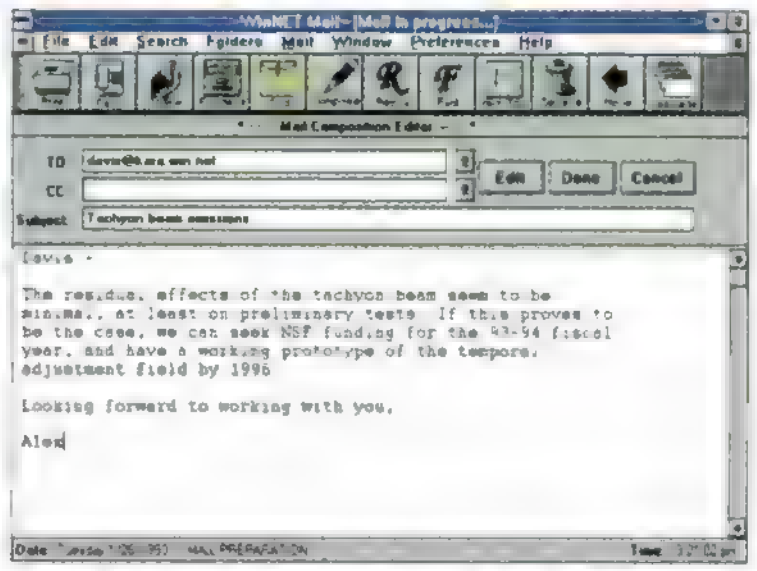
The first products to be MRCI-compliant will be from utility makers Symantec Corp. and Central Point Software. Symantec plans to make a future version of the Norton Utilities compatible with the MS-DOS 6.0 DoubleSpace file format. Norton's disk utilities will then be able to perform disk-error recovery tasks, as well as to optimize and defragment the disk. And Central Point will make a future version of PC Tools compatible with the DoubleSpace compression format in MS-DOS 6.0. The DiskFix utility and disk analysis tools will be MRCI-compliant.

But Microsoft's MRCI won't be the only compression API on the planet. As we went to press, Stac Electronics announced it was making its Stacker LZS technology available to third parties as the Stacker API—and that it was suing Microsoft for patent infringement. Whatever the outcome of the suit, however, it won't delay the release of MS-DOS 6.0: Stac has not filed for a temporary restraining order or for a preliminary injunction against Microsoft.
—*Christopher Barr*

Net Increase

MODEM USERS WHO HAD TO choose between pricey commercial services or the notoriously user-*un*friendly Internet can now reach the 6.5 million-member network through friendlier interfaces.

General Videotex Corp.'s Delphi service (800-695-4005) recently began offering something none of the other on-line services do: full Internet access. At $10 per month for 4 hours (plus $4 each additional hour), or $20 per month for the first 20 hours, subscribers can send mail to anyone with access to the Internet; join any of the thousands of mailing lists on topics ranging from beekeeping to semiconductor technology; retrieve files from any other computer that comprises the Net; read Usenet news; and use Telnet for remote login to any computer on the Internet.



WinNET Mail puts on a friendly face on the Internet.

Computer Witchcraft (415-752-2477) took a scaled-down but friendlier approach. WinNET Mail, a service/software combination, gives Windows users an inexpensive Internet mail address ($8 per hour). WinNET offers subscribers software, which makes creating an e-mail message as simple as clicking on the toolbar's Compose button. Users get access to mailing lists and Usenet news groups. The company has a help library for novices, and its technical support might be the best in the business: if they see you're having trouble, *they* call *you*.

The World, a public-access Unix system (617-739-9753) provides full access to the Net for only $2 an hour, plus a $5 per month account fee. The World offers help for new users in the form of on-line command lists, though the interface is Spartan. The service also sends subscribers a step-by-step guide to the Internet system.

Information about Internet has become more accessible with new books on the market. The $10.95 *Internet Companion* (Addison-Wesley, 800-447-2226) is probably the best guide for new users. The $24.95 *Whole Internet User's Guide and Catalog* (O'Reilly & Associates, 800-998-9938) is more extensive.—*Andrew Kantor*

Briefs

FOLLOWING THE LEAD OF PC AND monitor makers, seven printer manufacturers joined the Environmental Protection Agency's Energy Star program. Apple, Bull Italia, Compaq, Dataproducts, Hewlett-Packard, Kyocera, and Lexmark have all committed to designing energy-efficient printers.

THE STANDARD GENERALIZED MARKUP language gained an important ally when Novell began converting its printed manuals into on-line documentation. NetWare 4.0 will be Novell's first product to include on-line documentation, which was developed with SGML-based technology licensed from Electronic Book Technologies.

SITE LICENSE SOFTWARE HELPS network managers track what's on the net, but what about standalone machines? PC Integrity's CopyAlert prevents unauthorized programs from being installed on networked and standalone machines (800-742-7722).

NEC'S NEW WINDOWS NT EVALUATOR lets you test-drive the operating system. Priced at $7,000 with a 17-inch NEC MultiSync 5FG, it is based on NEC's PowerMate Express DX2/66e, and comes with 16MB of RAM, a 535MB SCSI hard drive, a MultiSpin CD-ROM drive, and a beta copy of NT.

QUARK AND FIVE OTHER DESKTOP publishing vendors are donating the full proceeds of the $49 Red Hot & Publish package to AIDS research. It contains Windows or Mac versions of XTensions for QuarkXPress, Photoshop plug-ins, and discounts on peripherals (800-788-7835).—*Mary Kathleen Flynn*

PDA Players

CONTINUED FROM PAGE 29

service. Apple, Sony, Matsushita, and Philips have experience with manufacturing, miniaturization, and consumer electronics, and each has well- established access to the necessary distribution channels. Besides supplying parts and know-how, each partner may license General Magic's technology for its own products.

General Magic's partnerships are far from being alone in the PDA market. Tandy, which announced a personal information processor called Zoomer, is marching lockstep with Casio. EO, which makes the 440 and 880 Personal Communicators, took AT&T, Matsushita and Marubeni as partners. Even Apple is dancing a tango with Sharp Electronics on the Newton PDA technology.

PDAs, because they bring so many disparate technologies together, necessitate partnerships. And in the new global economy, the companies that survive the nineties may be the ones that partnered best.—*Christopher Barr*

Powerful, Colorful, Light & Loaded.

The ZEOS® Color Notebook. Only $2495!

Remember what a difference it made when you switched to a color desktop? With the ZEOS Color Notebook, you'll enjoy vivid colors from a palette of 256 on your full-size 9.5" display. And there's more.

☑Fast drives and loads of storage with hard disk right up to *130MB*. ☑Unbelievable 25MHz SL performance, coupled with our 64K built-in cache. Standard. ☑Up to 20MB of high-speed RAM for the most demanding applications. ☑A built-in high density 1.44MB 3.5" floppy drive. ☑Serial, parallel, external VGA and keyboard ports. Use your system as a desktop PC too! ☑Send and receive fax/modem available, so you can always stay in touch. And that's not all.

THE INTELLIGENCE OF THE 386SL CHIP.

Intel designed the new 386SL processor specifically for notebooks. And they were right on target! You'll find that this sharp new processor extends your battery life significantly because it's intelligent enough to power-down the memory, disks, modem, and more when they're not in use. It's perfect for the stop-and-go computing that you're likely to do every day.

MANAGE YOUR POWER.

Or if you're working non-stop, you'll get even more out of the battery by using the programmable power management features. And here's another really neat benefit we know you'll love. You can change batteries without having to shut off the system! You can even use Suspend/Resume when you're working in Windows. Speaking of Windows . . .

FREE LOTUS SOFTWARE.

We don't just stop with great hardware. In packages 2 and 3 we're giving you—absolutely free—your choice of either Lotus 1-2-3, Ami Pro or Freelance Graphics. And that's in addition to DOS, Windows, and the new Lotus Organizer—the personal information manager highly recommended by *PC Magazine*. With all the free software you get from ZEOS, you save hundreds of dollars!

NEW LOOK! LOWER PRICES!

WE'RE HERE FOR YOU 24 HOURS A DAY.

Buying from ZEOS means you also receive our award-winning after-the-sale support and service: 24-Hour-a-Day Toll-Free Technical Support, 365 days a year. You also receive our 30-Day Absolute Satisfaction Money-Back Guarantee and One Year Limited Warranty.

You're going to be very satisfied. We guarantee it!

SERVICE • RELIABILITY • PC • READERS' CHOICE

BUY WITH CONFIDENCE.

ZEOS just won PC Magazine's *Readers' Choice for Service & Reliability (Feb. 9, 1993). We're the only PC vendor to earn the "Excellent" rating for both our laptop* and *desktop systems!*

FINALLY...AN AFFORDABLE COLOR NOTEBOOK.

Choose your package—or we can custom-build to your specifications!

PACKAGE #1
ONLY $2495

- 386SL-25 MHz CPU with 64K cache.
- 2MB RAM.
- 80MB high-speed IDE hard drive.
- Built-in high-density (1.44MB) 3.5" floppy drive.
- High-res 640x480 passive matrix color VGA LCD.
- A slim 8½"x 11¼"; total system weighs only 6.7 lbs. with battery!
- Light, slip-in, slip-out NiCad battery. 2.5 hours of battery life typical; more with power management.
- Trickle-charge or one hour quick-charge. Extra battery packs available.
- Suspend/resume—even in Windows.
- When battery runs low you can change batteries without having to shut off the system!
- 85-key keyboard with embedded numeric keypad, 12 dedicated function keys, and true 101-key emulation. Inverted "T" cursor layout.
- Serial, parallel, keyboard and external video ports.
- Math coprocessor support.
- 30-Day Absolute Satisfaction Money-Back Guarantee and complete ZEOS Customer Satisfaction Package.
- One Full Year Limited Warranty.
- 24-Hour-a-Day Toll-Free Technical Support, 365 Days a Year.

PACKAGE #2
ONLY $2995

Load up your Notebook! We've included free software, internal send/receive fax modem and more...an incredible value!

- 4MB RAM.
- 80MB IDE hard drive.
- Internal send *and* receive fax modem.
- Custom-fitted carrying case.
- Genuine Microsoft Mouse.
- *MS-DOS, Windows 3.1,* the new Lotus Organizer, and your choice of either *Lotus 1-2-3 for Windows, Ami Pro* or *Freelance Graphics for Windows.*

PACKAGE #3
ONLY $3495

Go to 8MB of memory, 130MB hard drive, extra battery...this could be the only PC you'll ever need!

- 8MB RAM.
- 130MB IDE hard drive.
- Internal send and receive fax modem.
- Custom-fitted carrying case.
- Additional slip-in, slip-out NiCad battery.
- Genuine Microsoft Mouse.
- *MS-DOS, Windows 3.1,* the new Lotus Organizer, and your choice of either *Lotus 1-2-3 for Windows, Ami Pro* or *Freelance Graphics for Windows.*

ORDER NOW TOLL FREE
800-554-7172

Fax Orders: 612-633-1325
Government: 800-248-2449
Outside U.S. and Canada: 612-633-6131
Hearing Impaired (TDD): 800-228-5389
MasterCard, VISA, Discover, American Express, Z-Card,® COD and Leasing Programs.
Open 24 Hours a Day, 365 Days a Year.

Purchase orders from Fortune 1000 companies, governments and institutions subject to approval. Leasing programs are available. All prices and specifications are subject to change without notice. Please call to confirm pricing, specifications and warranty details. All products and company names are trademarks or registered trademarks of their respective holders. © 1993, ZEOS International, Ltd., 1301 Industrial Blvd., Minneapolis, MN 55413 USA. ZEOS is a publicly traded company (NASDAQ symbol: ZEOS). CNB1R-PCM-9303B

CIRCLE 038 ON READER SERVICE CARD

At $1495, It's Your

BUY WITH CONFIDENCE.
ZEOS just won PC Magazine's *Readers' Choice for Service & Reliability (February 9, 1993). We're the only PC vendor to earn the "Excellent" rating for both our laptop and desktop systems!*

"...IF YOU'RE LOOKING FOR A SUBNOTEBOOK AND WANT TO MAKE NEXT TO NO COMPROMISES, THEN THE $1495 ZEOS CONTENDA IS YOUR BEST BET." —*PC WEEK*, FEBRUARY 1, 1993

We've got the winner!

It's the new ZEOS Contenda. More features than the Gateway Handbook. Cheaper than a Dell 320SLi by a long shot! And with the kind of quality, performance and support you've come to expect from one company, and one company only: ZEOS.

FEATURES THAT PULL NO PUNCHES.

PC Week calls it "the best yet of the new crop of lightweight, full-featured machines." And the chart says it all. Smart, powerful Intel 386SL CPU. A crisp, vibrant VGA backlit screen. Enough power and memory to *easily* run Windows: Standard 80MB hard drive and memory all the way up to 10MB. A built-in track ball. Up to 4 hours of power. Less than 4 pounds in weight. And that's not all.

Smaller than a notebook, powerful as a desktop. At only 3.9 lbs., the new ZEOS Contenda keeps you light on your feet.

IT COULD BE THE ONLY PC YOU'LL EVER NEED!

This is what you've been waiting for—the one PC to take with you everywhere you want to go! Because it's impossible to find a notebook on the market today that's this light, this small, this affordable—and still gives you *so much power.* But with the ZEOS Contenda, it's all here.

Like the SL processor. According to *PC Magazine*, when it comes to notebooks, you should look for Intel's SL processor. The ZEOS Contenda's Intel CPU extends your battery life significantly—because it's intelligent enough to power-down the memory, disks, modem and more when they're not in use.

And you'll find the Contenda gives you the power and room for practically everything you'd use in a desktop system! Such as DOS, Windows

#1 Contenda.™

and Windows applications. *And we give you all three!* Including the new Lotus Organizer—the personal information manager that's so easy to use, it could make your DayTimer obsolete. Check out our upgrade packages on the right for complete details.

And for you true road warriors, take a look at Package III. It gives you all the goodies—like a nylon carrying case, extra battery and internal fax modem—everything you need to stay productive on the road. All for under $2000!

	ZEOS Contenda	Gateway Handbook	Dell 320SLi
Processor	Intel 386SL	Chips & Tech. F8680	Intel 386SL
Processor Speed	25MHz	10MHz	20MHz
RAM	2MB to 10MB	1MB to 3MB	2MB to 10MB
Hard Drive	80MB	40MB	60MB
Screen	VGA Backlit	CGA Backlit	VGA Reflective
Runs Windows	Yes	No	Yes
Built-in Pointing Device	Yes	No	No
Footprint	9.7" x 6.1"	9.8" x 5.9"	11.0" x 7.8"
24 Hour Support	Yes	No	No
PRICE	$1495	$1295	$1898

YOU GET CUSTOMER SUPPORT THAT'S THE BEST IN THE BUSINESS.

Our relationship with you doesn't end once we ship your Contenda. ZEOS pioneered comprehensive customer support, and it's what keeps our customers coming back again and again. We back all of our products with Toll-Free Technical Support, 24 hours a day, 365 days a year.

And we guarantee your satisfaction. If you're not absolutely convinced your new ZEOS Contenda is everything we say and more, you have a full 30 days to return it to us for a complete, no-questions-asked refund. Plus, you're covered by our One Full Year Limited Warranty and much more. You're going to be very satisfied. *We guarantee it!*

CALL NOW TOLL FREE
800-554-7172

Chart information compiled February 3, 1993. Purchase orders from Fortune 1000 companies, governments and institutions subject to approval. Leasing programs available. All prices and specifications subject to change without notice. Please call to confirm pricing, specification and warranty details. All products and company names are trademarks or registered trademarks of their respective holders. © 1993 ZEOS International Ltd., 1301 Industrial Blvd., Minneapolis, MN 55413 USA. ZEOS is a publicly traded company, NASDAQ symbol: ZEOS. SN-PCM-9303B

CIRCLE 036 ON READER SERVICE CARD

CONTENDA PACKAGE I:
$1495

- CPU: Intel 386SL
- Processor Speed: 25MHz
- RAM: 2MB expandable to 10MB
- Hard Drive: 80MB
- Display: VGA backlit, 640x480, .23 dot pitch, Sharp 7.4" diagonal
- Battery: NiMH; operating time up to 4 hours; a snap to remove
- Size: 9.7" x 6.1"
- Weight: Only 3.9 lbs.
- Power Management: Fully featured, including De-turbo, Standby and Suspend
- Keyboard: Comfortable 80-key with embedded numeric keypad
- I/O Ports: 1 serial and 1 parallel standard; ports for optional internal modem, external floppy and external color VGA monitor
- Pointing Device: Easy-to-use built-in trackball
- Warranties & Guarantees: ZEOS award-winning 24-Hour Toll-Free Technical Support, 30-Day Absolute Satisfaction Money-Back Guarantee, complete Customer Satisfaction Package

CONTENDA PACKAGE II:
$1795

We take Pkg. I and upgrade to 4MB RAM, add an external 3.5" floppy drive, DOS, Windows and Lotus Organizer!

CONTENDA PACKAGE III:
$1995

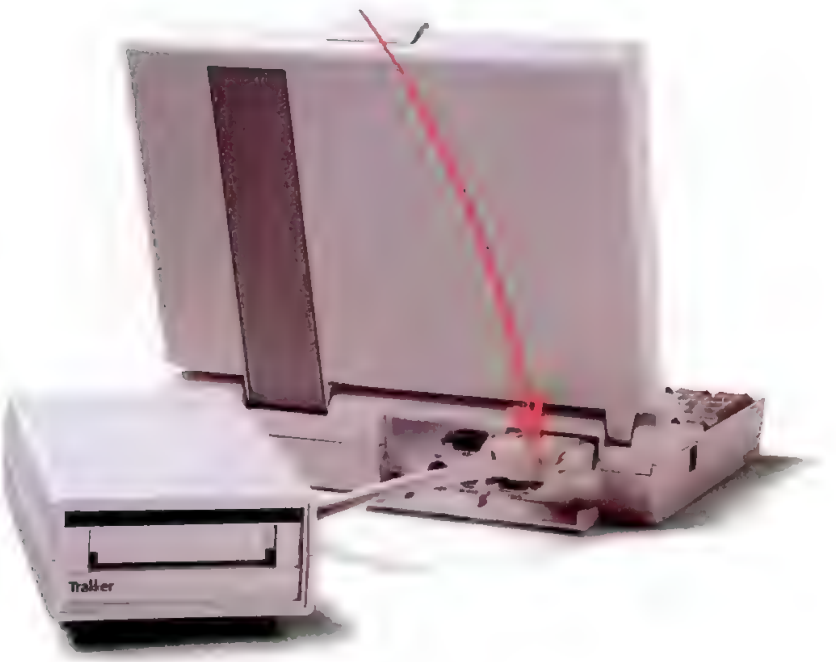
All of pkg. II plus a nylon carrying case, extra battery, and internal 9600/2400 baud fax modem. The whole enchilada for less than $2000!

CALL NOW TOLL FREE
800-554-7172

Fax: 612-633-1325
Govt.: 800-245-2449
Hearing Impaired (TDD): 800-228-5389
Outside U.S. and Canada: 612-633-6131
MasterCard, VISA, AmEx, Discover, Z-Card,SM COD and affordable leasing programs.
Open 24 Hours A Day, 365 Days A Year!

Plug and Play Tape Backup.

The Plug.



That's it. Go Play.

Now, tape backup is easier than ever. Unpack Trakker and plug it into your computer's parallel printer port. That's it. No assembly, no installation, no problem.

Trakker goes anywhere. It's light and compact, the ideal solution for backing up notebooks and laptops. And Trakker can back up unattended, so you can go anywhere, too. Trakker is available in two models. At $448, Trakker 120 (120 Megabyte capacity, using data compression) is the price leader. And Trakker 250 (250 MB capacity using data compression) is the fastest in its class at up to 8 MB/minute. Both give you QIC Industry Standard Recording Format, as well as Novell® and LANtastic® certification.

For a FREE 76-page catalog, please call **1-800-451-0897** ext. 222 today.

Trakker™

Backup so simple it's advanced.™

COLORADO™ MEMORY SYSTEMS INC.

Mini data cartridge sold separately. © 1992 Colorado Memory Systems Inc. All rights reserved. Jumbo, Trakker and Colorado are trademarks of Colorado Memory Systems, Inc. All other trademarks are property of their respective companies. JTB-PCM011593

CIRCLE 073 ON READER SERVICE CARD

First Looks

HANDS-ON EVALUATIONS OF THE NEWEST SHIPPING PRODUCTS

Windows Printing System

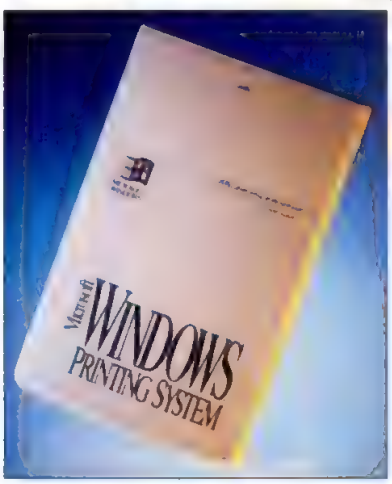
Microsoft Makes Windows Printing Easier And Faster

BY MARY KATHLEEN FLYNN

It can be tempting to dismiss Microsoft's "making Windows easier and faster" campaign as just so much marketing hype, but the software giant's hardware designers are clearly taking the message to heart. Despite some limitations, the company's latest foray into hardware, the $199 Windows Printing System, does indeed make Windows both easier and faster.

Designed to work with any Hewlett-Packard LaserJet II or III printer, the Windows Printing System consists of an add-in cartridge and software for both the printer and the host PC. The package also includes 79 TrueType fonts (equivalent to the 35 typefaces that are found in HP's LaserJet IV and PostScript printers). Because the display fonts and printed ones are the same, you get "truer" WYSIWIG.

The primary purpose of the Windows Printing System is to boost the speed of printing Windows documents—and on our tests, it accelerated printing up to 60 percent. The system also adds some unprecedented ease-of-use features.



SAME LANGUAGE: *The WPS knows GDI.*

EASY INSTALLATION

Installing the Windows Printing System is simple. Turn off your printer, slide the cartridge into the LaserJet's left-hand slot, and load the software. The recommended Express installation takes about the same length of time it takes to install Windows; the Custom option lets you save disk space by eliminating the font files or sound files (which don't work on a network printer, for example). You'll need nearly 8MB of free disk space to install the whole program. Unlike most Windows products—even other hardware products from Microsoft, such as the Windows Sound System and Video for Windows—the WPS does not provide an option to install it on a hard drive other than the one you've got Windows on. Unfortunately, the short manual fails to make this subtle point.

Continues on page 38

IN FIRST LOOKS

Sound Blaster 16 ASP 40
FirstApps 2.0 42
DeScribe Word Processor 4.0 44
Kinesis Ergonomic Keyboard 44
Fargo Primera Color Printer 46
ImagePals 2.0 48
ABC FlowCharter 2.0 49
HALO Desktop Imager 2.0 49
TurboCAD Professional 1.0 for Windows 50
Diamond Viper VLB3 52
NDI Volante Warp24LB LB 50 52
Micro Solutions backpack CD-ROM 53
ZyImage 1.0 56
Sherlock 1.0 56

Color Printers

Tektronix Phaser 200i Hits a New Price/Performance Mark

BY ALFRED POOR

Last year's *PC Magazine* annual printer issue included only two color page printers priced less than $6,000, but now Tektronix has added two more 300-dot-per-inch color printers to the market: the $5,995 Phaser 200i and the $3,695 Phaser 200e. Both are networkable thermal wax transfer PostScript printers, and both are fast. In fact, the 200i is faster than any of the color page printers we saw last year at *any* price.

The biggest news, however, is that unlike most thermal wax transfer printers, which require special coated paper, both of the Tektronix printers accept plain paper.

Tektronix's new ColorCoat technology is the key. Instead of using standard three-color ink rolls, with bands of cyan, magenta, and yellow, ColorCoat adds a fourth, clear panel. The printer puts down a layer of this clear material at all the points on the page where one or more of the other three colors will print. The clear coat is specially designed to adhere to the rougher surface of plain bond paper, and it provides a smooth, "coated" surface for the colored wax inks.

The result is impressive. Using an ink roll designed for coated paper gave very poor results on plain paper, but switching to the ColorCoat roll made a dramatic difference. Ink coverage for solid areas was much better, and there were few drop outs on the strokes of text characters. Since the clear coat is

COMPACT: *The 200i is 13 inches wide.*

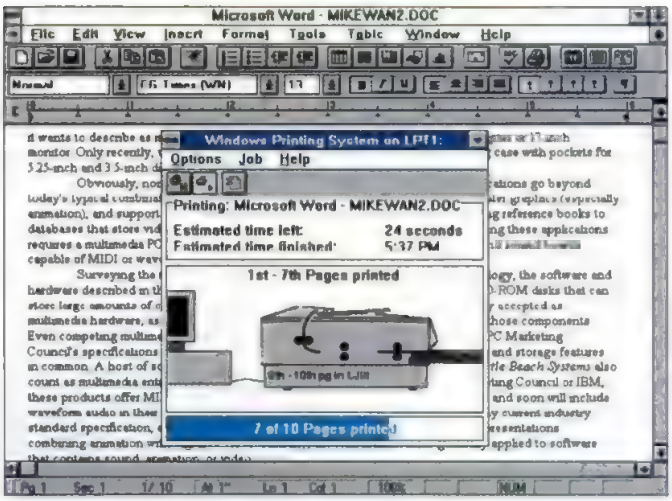
Continues on page 39

Printing System

CONTINUED FROM PAGE 37

Once installed, you restart Windows with the simple press of a button, and the WPS automatically becomes your current printer driver. Print the Test Page, and you'll see everything you ever wanted to know about your printer—including how much memory it has (and how much of it is free) and how many pages it has printed over the course of its lifetime.

To access the WPS, you can go through Print Manager or Control Panel (in either case, whatever options you set up will apply to all Windows-based print jobs until you change them), or through your Windows application (in which case, options will apply only to that print job or document). Options include standard settings, such as page orientation and size, as well as some special graphics settings, such as printer resolution and halftoning methods (selecting the Solid Black and White option, for example, posterizes photographic images). You can also choose whether or not to display the printer's status, as full- or icon-sized, as an animated graphic, or as a progress bar.



ARE WE THERE YET? *The animated Status window shows you how long the print job will take and when it will finish.*

ANIMATED STATUS

By far, the most fun element of the WPS is the Status window. At the beginning of the print job, it estimates how long the job will take and what time it will finish. Throughout the job, the Status window tells you how much time is remaining, how many pages have printed, and how many are left. An animated drawing lets you watch each page as it travels through the printer's paper path. Sound files tell you when the job has started and when it has finished. When the novelty of these features wears off, you can just turn off the sound and display the Status window as an icon. A progress bar above a picture of your printer will tell you the percentage of pages that have finished printing.

These features do far more than entertain entry-level users. They allow the WPS to send you alerts when the printer needs your attention—when it's out of paper or the paper has jammed, for example. The alerts are even color-coded: red shows you the type of problem and green tells you how to go about correcting it.

The WPS provides this feedback by taking over the parallel port, remapping its pins, and giving it bidirectional communications capabilities. The printer manufacturing community (with help from both Hewlett-Packard and Microsoft) is actively working on bringing bidirectional communications to tomorrow's printers, but this kind of intelligence is still very rare in printers today.

FIRST LOOKS PLUS

To download information about the Windows Printing System from PC MagNet, type GO ZNT:DEMOS from any CompuServe prompt. From March 15 through 19, you can go on-line to discuss the product with Mary Kathleen Flynn and Microsoft product manager John Misko. Type GO ZNT:EXEC.

SPEED BOOSTS

The WPS also uses some advanced technology to achieve its performance gains. First, it makes direct calls to the Graphics Device Interface in Windows, thereby eliminating the need to translate between the GDI and the HP-PCL printer language. Other printers, most notably LaserMaster's WinPrinters, use host-based GDI drivers, but the Windows Printing System is the only product that puts a subset of GDI in the printer itself. Second, it intelligently manages resources (such as memory) between the GDI host PC and the printer.

But how big a speed boost the WPS will give you depends on your configuration, the types of files you print, and whether or not you usually turn off the Print Manager. The less memory you have, the bigger the difference the WPS will make. On a LaserJet III with 1MB (the most common configuration in the installed base, according to Hewlett-Packard), PC Magazine Labs found that the WPS improved printing speed from roughly 30 to 60 percent, depending on the file; whereas with 5MB, the improvement was only 25 to 45 percent.

If you regularly print files with mixed text and graphics, you'll get the biggest impact from the product, according to Microsoft. On our tests—using documents created with Word for Windows, Excel, CorelDRAW, and QuarkXPress for Windows—we saw the greatest improvement with large spreadsheets and the least improvement with word-processing documents.

One factor you should consider is the impact of turning off the Print Manager. On our tests with the Print Manager off, the WPS performed only 20 to 25 percent faster than the HP-PCL driver. But before you rush to disable the Print Manager, keep in mind that you won't be able to use your system until your document finishes printing.

One limitation of the Windows Printing System is that the only font technology it works with is TrueType. At press time, however, Microsoft was working with Adobe to provide a way for Adobe Type Manager users to take advantage of the WPS.

Faced with the choice between buying a new printer for a couple thousand dollars or souping up the old one for a couple hundred (or less), many users will find picking the Windows Printing System a no-brainer. □

Windows Printing System

Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-882-8080.

List price: $199

Requires: 7 5MB hard disk space, HP LaserJet II, IID, IIP, IIP+, III, IIID, or IIIP, Microsoft Windows 3.1

In short: An add-in cartridge with software including 79 fonts for HP LaserJet IIs and IIIs, the Windows Printing System makes printing with Windows easier (through bidirectional communications, an on-going animated status report, and "truer" WYSIWYG) and faster (20 to 60 percent faster on PC Labs' tests

430 ON READER SERVICE CARD

Tektronix

CONTINUED FROM PAGE 37

only applied to areas where the colored ink will print, the rest of the page retains its normal, plain-paper texture instead of taking on the slippery coated-paper feel.

As good as the ColorCoat process may be, it still doesn't match the results you can get with coated stock. With coated paper, color coverage was noticeably smoother and there were fewer flaws in text sections.

Surprisingly, it can cost more to print on plain paper than on coated paper. Using Tektronix's own figures, a printed page on coated paper will cost $0.56, but on plain paper the cost actually rises to $0.65. The reason is that the clear panel reduces the number of prints you can get from an ink roll: 324 pages with the 3-color roll for coated stock, and only 214 pages with the ColorCoat rolls.

The clear coat is significantly louder when being applied than the ink coats are, making a noticeable tearing noise in the process. This is not a sound you want to have nearby when you're on the phone.

As a result, the only advantage for the ColorCoat process is in instances where you need to use plain paper (such as preprinted letterhead or report covers).

NEW COLOR TECHNOLOGY: *The Phaser 200i uses the ColorCoat process to print on plain paper.*

TWO MODELS

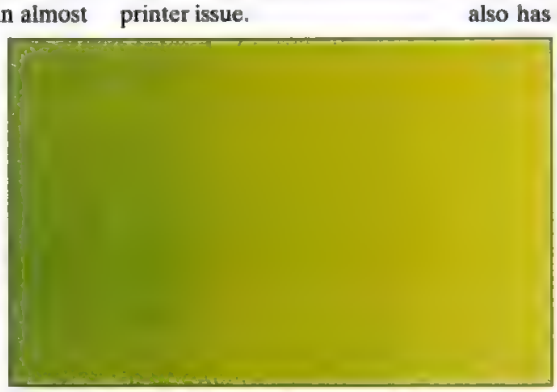
The Phaser 200i and 200e are nearly identical in every respect, from the ColorCoat technology to their optional lower paper tray ($495), which adds an additional 200 sheets of paper (trays may be selected under software control). Both use true Adobe PostScript Level 2, which provides improved color-support and image-compression features, and both include an HPGL plotter emulation mode. The printers come with parallel, serial, and Appletalk connectors and also have TCP/IP and DECnet options available (and the 200i can accept an EtherTalk option).

These new Phasers are remarkably compact. With dimensions of 11.0 by 13.4 by 17.5 inches (HWD), you can almost fit one on a ledger-size sheet of paper. The fact that the paper tray fits inside the bottom of the case helps keep the footprint small.

Interestingly, Tektronix offers special paper for letter-size images. Like most thermal transfer printers, the paper transport mechanism clamps about an inch of the sheet of paper; this makes it possible to get extremely accurate registration for the three (or four) passes by the print element. The problem is that the clamping creates an unprintable region on the page. Tektronix has solved this problem by offering special paper with a perforated strip along the bottom (available in both coated- and plain-paper stocks) so you can get an 8.1- by 10.6-inch image on a letter-size sheet of paper.

The two models differ primarily in terms of speed, fonts, and memory. Both use a print engine rated at two pages per minute, but the Phaser 200i (which we tested) comes with a 24-MHz AMD RISC processor; the 200e uses a 16-MHz version of the chip.

With the 200i, we measured graphics speed times of 1.03 graphics pages per minute (gppm) on coated paper with the *PC Magazine* Printer Benchmark tests, and 0.76 gppm on plain paper. These times were faster than any of the color PostScript printers that were reviewed in last year's printer issue. The 200e should manage at least two-thirds the gppm ratings of its more expensive sibling, which would also place it at the top of the pack from last year's printer issue.



SMOOTH COLOR: *Gradient fills are excellent.*

The 200i comes with a full complement of 39 Adobe fonts, plus a SCSI port that accepts a hard disk for additional font storage. The 200e only includes 17 fonts, and while it can be upgraded to 39 fonts with the addition of a special SIMM, it doesn't have the SCSI port option. The 200i comes with 6MB in the base model, and accepts one or two 4MB upgrades for a maximum of 14MB. (Our evaluation unit came with a total of 10MB installed.) The 200e has 4MB in the base model, and only accepts a single 4MB upgrade for a maximum configuration of 8MB.

Both printers are Pantone certified, and also come with features that let you adjust the printed output to compensate for differences between the way your printer and monitor display shades of blue. The 200i also has a Press Color Adjustment feature that can be used to simulate printing press colors.

Many users will find the Phaser 200e well-suited for general business needs, especially at its competitive price. If you need the extra fonts or extra speed, the 200i is still an affordable and attractive option, especially in networked situations. While the ColorCoat feature is impressive, most users will probably stick to coated stocks to get the best results possible. □

FACT FILE

Phaser 200i

Tektronix Inc., P.O. Box 1000, Wilsonville, OR 97070; 800-835-6100; 503-682-7377.

List price: $5,995; 200-sheet bottom paper tray, $495; 3-color ink roll (324 pages), $165; ColorCoat plain paper ink roll (214 pages), $126.

In short: The Phaser 200i and its slower sibling, the 200e, are fast and affordable color PostScript printers. Their ability to print on plain paper is attractive, but coated paper still provides the best quality results.

428 ON READER SERVICE CARD

■ Multimedia

Sound Blaster 16 ASP: A Wealth of Noisy Software

BY MARK BROWNSTEIN

The $349.95 Sound Blaster 16 ASP is the most ambitious sound card yet from Creative Labs, the company that first made PC-sound serious. The new 16-bit card is still fully Sound Blaster—compatible, but that's just the start.

The new Sound Blaster is capable of recording or playing stereo audio with a sampling rate of up to 44.1 kHz, a rate that produces CD-ROM–quality audio. In fact, you can use the card to record directly from a CD-ROM or through other sound sources.

External connections let you attach any stereo sound source by plugging in an included miniplug. This is the same size plug used for Walkman radios, but with standard RCA plugs at the other end that let you plug into the back of a CD, tape player, stereo VCR, or other device. The recording setup lets you choose the audio source (CD audio with an internal connection, line in, microphone, .VOC or .WAV file, or MIDI), and select which channel goes where on a stereo recording.

What this does is let you take a monaural sound source and record it in both channels. The audio mixer does a good job of combining sources.

If you want your audio masterpiece to be played through your stereo with the best quality, you set the Sound Blaster 16 ASP to output your sound at standard levels without amplification. This option creates the highest fidelity signal possible, and is CD-quality when recorded at the highest data rate.

The biggest problem with the highest-quality mode is that it rapidly fills a hard disk. Recording at this rate takes many megabytes per minute of sound, so it's most suitable for playing large selections that are recorded onto CD-ROM, rather than for recording messages or your own masterpieces.

Sound Blaster 16 ASP
Creative Labs Inc., 1901 McCarthy Blvd., Milpitas, CA 95035; 800-998-5227, 408-428-6600; fax, 408-428-6611

List price: $349.95
In short: The Sound Blaster 16 ASP can record and play sounds at CD-quality levels. Included software makes the card more useful than ever.
418 ON READER SERVICE CARD

ADVANCED SIGNAL PROCESSOR

The ASP in the product name refers to what Creative Labs calls an Advanced Signal Processor. This signal processor is currently underutilized; in the future, it will probably be used for such things as voice recognition and even telecommunication (with the addition of the appropriate daughterboard).

The signal processor is capable of recording and playing back compressed audio. A compression ratio of approximately 4:1 provides an audio signal that sounds virtually the same as the original uncompressed source, while taking up less than three megabytes per minute.

The Sound Blaster 16 ASP supports OLE, and that lets you embed a sound "object" OLE-client applications. If you're using a spreadsheet and want to voice annotate a cell. You can record and insert a note. A microphone is included.

RICH SOFTWARE SET

In addition to its mixing, recording, and playback capabilities, the Sound Blaster 16 ASP comes with a rich set of software. Creative Labs has upgraded many of the original Sound Blaster utilities. There's a .WAV/.VOC player, a DOS recorder, a text-to-speech processor, and a MIDI and .CMF music player. MMPlayer, a multimedia scripting and playback utility, combines sound with captured screens.

Microsoft Windows utilities include a talking scheduler, a mixer, a MIDI player, and a .WAV file editor. A special version of HSC Interactive provides a simple user interface for creating multimedia presentations, and PC Animate Plus lets you create animated presentations. Once created, the presentation can be added to an HSC Interactive presentation and made to talk or play music.

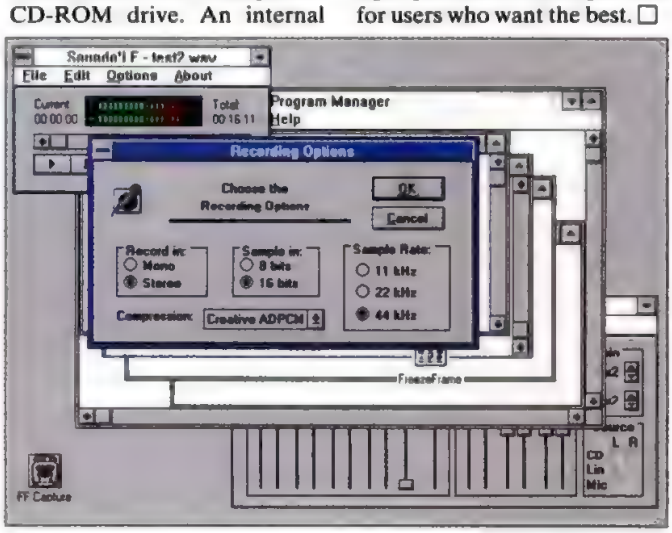
Monologue for Windows, another program bundled with the Sound Blaster 16 ASP, converts text to voice for reading back spreadsheet data or word processing files.

A CD-ROM interface controls an internal Creative Labs CD-ROM drive or a compatible CD-ROM drive. An internal connector also takes audio output from an incompatible CD-ROM drive, playing the sound, but not controlling the CD-ROM's function.

A MIDI port is also built into the board for connection to a MIDI device (such as a keyboard). The port can also be used as a game port.

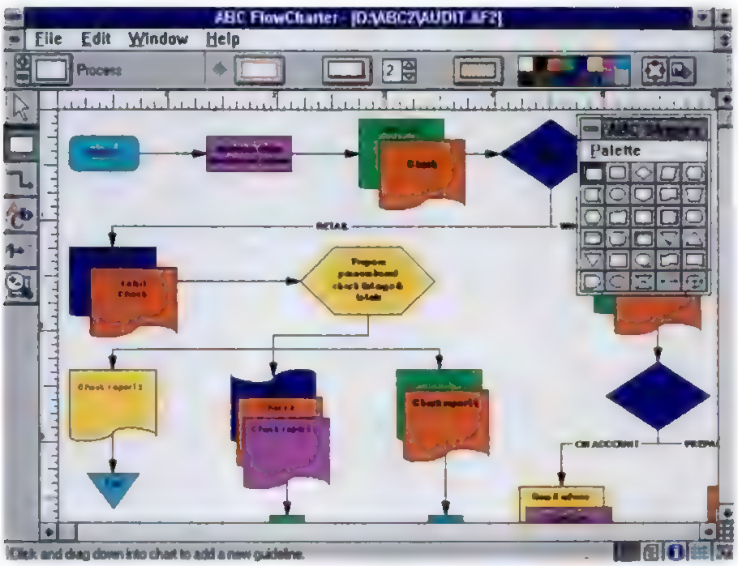
A $295 enhancement daughtercard called the Wave Blaster attaches to the Sound Blaster. When MIDI music is played through the speaker, it is normally synthesized sound, making the music sound like something played by computer. With the Wave Blaster, however, you get to play a fully digitized sample. The result: music that sounds like it's being played by real instruments.

The question may really come down to this: Is any sound card, no matter how high-quality, really worth the $300 or so street price? With OLE for embedding sound for business applications, the ability to record CD-quality audio, and the included software, for some people the answer may now be yes. It's still a lot of money, but with the upgrade options that ASP supports, MPC compatibility, and the rich software products included (and Sound Blaster and AdLib capability for playing video games), the Sound Blaster 16 ASP is the right product at the right time for users who want the best. □



RECORDING: *The new Sound Blaster can record CD-quality sound.*

All-new ABC FlowCharter 2.0 makes flowcharting faster, easier than ever!



Now the leader in Windows graphics puts its know-how behind the world's #1 Windows flowcharting solution!

Introducing ABC FlowCharter® 2.0 from Micrografx. With all the terrific features of the original. Plus an array of exciting *new* features that make it better, faster, easier than ever!

Our all-new user interface conveniently displays tools in a handy toolbox. No more searching through menus. Just point and click!

Customizable shapes and shape palettes let you tailor ABC FlowCharter 2.0 to your particular applications. And we've added new palettes of symbols for specialized charts like dataflow diagrams, audit diagrams, and many, many more.

"A Windows-based package that's both powerful and easy to use."
InfoWorld
April 20, 1990

"Turns making flowcharts into child's play."
DBMS Magazine
August 1991

You'll be able to choose from new line types and styles, including curved lines. And take advantage of an exciting new feature that automatically connects shapes.

Enhanced text capabilities let you edit text right on the chart, and mix different fonts, sizes and styles at will.

And best of all, you'll enjoy our friendly 24-hour telephone support (weekend hours too).

If you're already an ABC FlowCharter user, call now for upgrade information. And if you're not, find out just how fast and easy flowcharting can be – with all-new ABC FlowCharter 2.0!

CALL TODAY FOR UPGRADE INFORMATION
1-800-578-6131

M I C R O G R A F X®

Micrografx, Inc., 1303 Arapaho, Richardson, TX 75081 (214) 234-1769. Micrografx has offices in Toronto, Paris, London, Munich, Milan, Sydney, Copenhagen and Tokyo. Copyright ©1992, Micrografx, Inc. All rights reserved. Micrografx and ABC FlowCharter are registered trademarks of Micrografx, Inc.

CIRCLE 361 ON READER SERVICE CARD

■ Windows Utilities

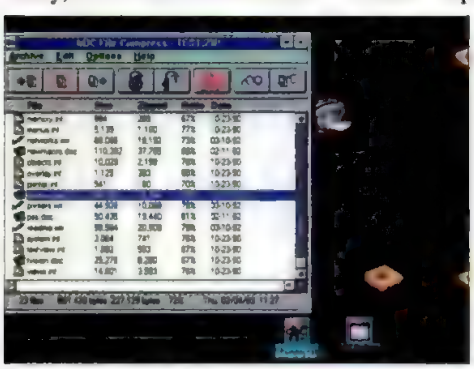
FirstApps 2.0: 20 Hot Windows Tools

BY BARRY SIMON

hDC Computer Corp.'s update of FirstApps, its $99.95 collection of 20 Microsoft Windows utilities, includes many new tools and features, most notably the enhanced command technology that is a key component of hDC's Power Launcher. The collection has updates of original FirstApps tools and even includes some of the features of FileApps, hDC's other collection of Windows utilities.

The 20 utilities in FirstApps, Version 2.0, include five file-manipulation utilities, four system-reporting programs (memory, resources, disk space, and fonts), six system-manipulation tools, a game, two graphics utilities, an alarm program, and a utility for customizing hDC products.

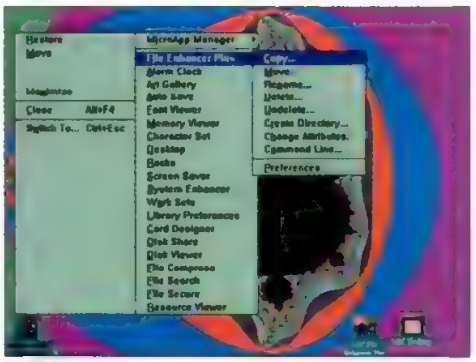
Each utility will run separately, but hDC includes a management tool that gives you quick access to all of the utilities. It lets you attach each of their commands to the system menu of any window.



COMPRESSION: *FileCompress does archiving.*

This is especially useful in the case of File Enhancer Plus, which adds menu items for copying, moving, deleting, and restoring files, for creating directories, and for changing attributes to the screen. These menus are handy if you're in an application and you want to take care of a few file-management tasks quickly.

In addition to file handling, File Enhancer Plus' menu includes an item for invoking the hDC command builder. New to Version 2.0, this item is similar to the command builders in Power Launcher and Windows Express that help you automate several-step procedures (see "Windows Express Update").



EASY ACCESS: *FirstApps' MicroApps Manager.*

COMPRESSION TOOL

The new File Compress, a fully .ZIP-compatible data-compression utility, is self-contained and doesn't require a separate copy of PKZIP. It includes support for both PKZIP 1.1 and the newly released PKZIP 2.0, and unlike PKZIP 2.0, File Compress will make either 1.1- or 2.0-compatible .ZIP files. Remarkably, the PKZIP 2.0-compatible archives that File Compress makes can be smaller than those produced by PKZIP 2.0 itself. For example, with the mix of text files we used in our tests of PKZIP 2.0 (First Looks, March 16, 1993), the .ZIP file created by File Compress was 2.5 percent smaller than the one PKZIP 2.0 made.

FirstApps 2.0's Desktop module is another of its highlights. It lets you replace Windows wallpaper with a calendar, a fractal design (beware its 3MB size), or any After Dark screen saver. That means you have flying toasters passing by all the time, not just when After Dark kicks into operation.

The Work Sets tool lets you group related documents and applications together so that everything connected to a project can be found in the same place. Work Sets can also save your current desktop setup. There's also an Auto Save feature that you can set to save all your work periodically.

The utilites in FirstApps 2.0 vary from the simple to the multifaceted, but none is a waste of your disk space. Any Windows user will find many of them indispensable.

• List price: *FirstApps, Version 2.0, $99.95.* Requires: *2MB RAM, 1MB hard disk space, Microsoft Windows 3.0 or later. hDC Computer Corp., 6742 185th Ave. NE, Redmond, WA 98052; 800-321-4606, 206-885-5550; fax, 206-881-9770.*

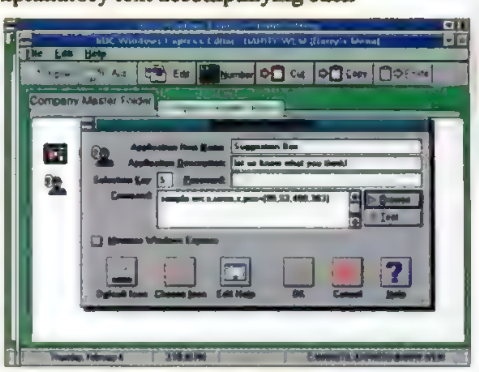
Circle 424 on reader service card

■ Windows Express Update

If you are one of the many Microsoft Windows users who doesn't readily embrace Program Manager's dozens of icons and its barrage of disappearing windows, help is available. Why not put a DOS-like menu interface onto Windows, but make it good-looking, flexible, and entertaining?

hDC's $99.95 Windows Express, newly upgraded to Version 4.0, is the tool you're looking for. Since the multilevel menus look like file folders, you can instantly see where you are. The menu items can have long names (up to 50 characters) with explanatory text accompanying each name.

In Version 4.0, the menu items can invoke hDC enhanced commands, which you can string together into several-step macros that launch one or more applications and control their starting screen positions, prompt users for filenames, send keystrokes to apps, or invoke DDE commands.



FAMILIAR FACE: *Windows Express hides Program Manager's confusion.*

That kind of control may not be necessary for the individual Windows user, but it's a boon for network administrators who want to set up large custom menus.—*BS*

The Best Way To Send, Receive and Manage Faxes

Introducing WinFax PRO 3.0

WinFax PRO 2.0 made it easy to send and receive faxes, winning *PC Magazine's* prestigious *Best of 1991* award in the process. But we didn't stop there. New WinFax PRO 3.0 changes the face of PC faxing once again, putting a full spectrum of powerful tools at your fingertips.

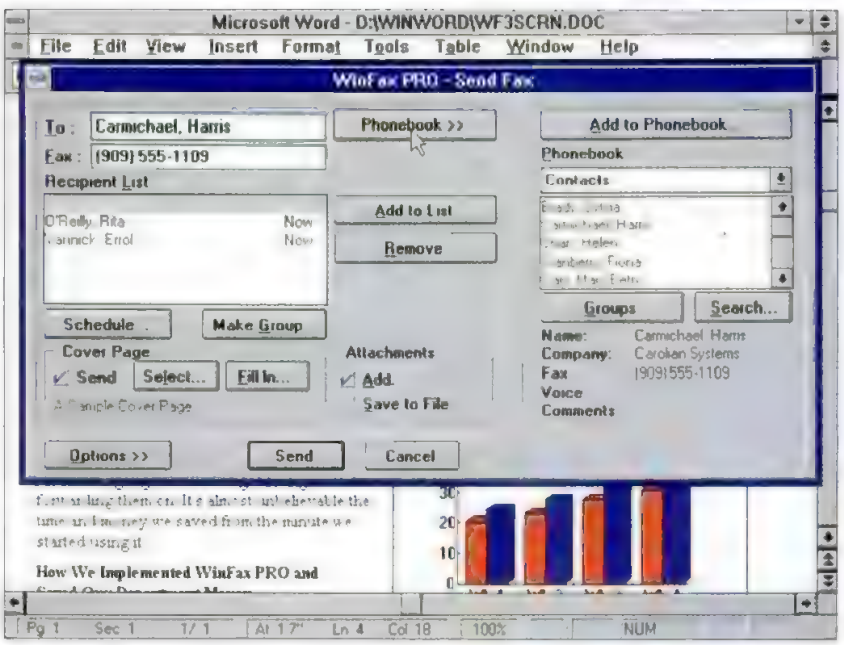
The Freedom of PC Faxing

Now, you can "one button" fax from any Windows application to any fax machine in the world. Easily combine documents from multiple applications and fax to individuals or groups anytime you want. All from the convenience and privacy of your own PC. The wasted time and aggravation of old-fashioned faxing is a thing of the past.

Powerful Tools To Manage Your Faxes

WinFax PRO's advanced document management tools enable you to file, track and quickly find the faxes you've sent or received. Mark up faxed documents right on screen, using our fully featured text and graphic annotation tools. And AnyFax™, the most advanced OCR software for faxes, directly converts them for editing in your favorite word processor or spreadsheet.

Plus, as a special introductory offer, WinFax PRO 3.0 contains Cover Your Fax™ – **a FREE $39.95 value – for a limited time only**. 101 great fax cover pages to suit all occasions. Perfect for your business or personal use.



Easily send faxes to any fax machine in the world... directly from any Windows application. Since WinFax PRO 3.0 installs just like your printer, you can fax anything that you can print.

- Receive faxes in the background
- Include multiple documents in a single fax
- Organize faxes for easy retrieval
- Convert faxes into word processing documents using OCR
- Annotate faxes with text and drawing tools
- Use advanced phonebook features, including dBASE compatibility
- Create custom fax cover sheets

PC MAGAZINE BEST OF 1991 — WinFax PRO 2.0

MVP FINALIST — WinFax PRO 3.0

1992 W 100 WINDOWS MAGAZINE ANNUAL WIN AWARD — WinFax PRO 2.0

Here's what the experts say:

"The best faxing software money can buy." *PC Computing*

"If you're looking for fax software, get anything with Delrina's name on it." *John C. Dvorak Syndicated Columnist*

"A small software miracle." *PC Magazine*

For your FREE Information Kit, or to upgrade from any other Delrina fax software, call

1-800-268-6082

DELRINA

In the UK call 081 207 3163; other countries call (416) 441-3676. OEM product available. WinFax PRO, Cover Your Fax, and Delrina are trademarks of Delrina Technology Inc. AnyFax is a trademark of Caere Corporation. All other product names are trademarks of their respective owners. © 1992 Delrina Technology Inc. All rights reserved.

CIRCLE 250 ON READER SERVICE CARD

OS/2 Word Processing

DeScribe: Acrobatic 32-bit Word Processing In OS/2

BY EDWARD MENDELSON

DeScribe Word Processor, the only word processor designed from the ground up to work under OS/2, performs amazing acrobatic feats of editing and display that leave rival programs gasping in envy.

Version 4.0 of DeScribe's $495 package includes drag-and-drop editing and collapsible outlining, and can search and replace two sets of text strings at once or play back and undo every keystroke and graphic operation since the start of the current session. The program sometimes stumbles, however, when attempting basic tasks. If you need footnotes, table math, or a thorough help system, you may want to look elsewhere.

DeScribe's editing screen shows either a zoomable WYSIWYG view complete with the top and bottom margins of the page, or a customizable draft view. You can open multiple windows on the same file at once, and edit in any of them. A customizable palette of baffling icons floats above the screen, and you can drag and drop documents from OS/2's desktop onto these icons for instant processing.

The program opens as many files as memory permits, and remembers the cursor position when you close a file. The infinite undo function lets you return to any earlier stage in the current session, copy long-lost text or graphics to the clipboard, and paste the nugget into the version of the file you're presently editing.

Format dialogue boxes are awkwardly designed and often lack keyboard shortcuts. A "stationery manager" lets you overlay letterheads or "rubber stamps," such as a gray "Confidential" on text, and you can drag and drop the overlays to an Insert icon. However, you can't preview the results.

DeScribe includes good indexing with entries that span multiple pages. The speller displays definitions and antonyms. You can insert special characters from a symbol menu that lets you store and display selected symbols from different fonts. But if you want to search for a paragraph mark, you have to remember to type Alt-020 on the number pad. Programmable macros and merges don't equal those in Windows programs.

OS/2's multithreading lets DeScribe include an option to print in the background. Without background printing enabled, however, DeScribe takes four times as long as Ami Pro or Word for Windows to return control of the computer to you after a print command.

The program offers only limited multithreading, so options such as the symbol menu and the undo control can't be on-screen at the same time. File imports are agonizingly slow and erratic, and the program sometimes shuts down and disappears when printing imported files.

DeScribe's 32-bit architecture is designed to give it a speed advantage over 16-bit Windows programs, but Ami Pro, running in a "seamless" OS/2 Windows session, generally outpaces it.

DeScribe does the job if you need a full-featured OS/2 word processor now, but for speed and elegance, you may prefer to use Ami Pro or WordPerfect for Windows under OS/2 until OS/2 versions of both programs arrive later this year.

• List price: *DeScribe Word Processor, Version 4.0, $495 (10-user LAN version, $1,995, 20-user LAN version, $2,995).* Requires: *6MB RAM, 4MB hard disk space, OS/2 2.0 or later. DeScribe Inc., 4234 North Freeway Blvd., #500, Sacramento, CA 95834; 800-448-1586, 916-646-1111; fax, 916-923-3447.*

Circle 421 on reader service card

MULTITHREADING: *DeScribe's undo is limitless.*

Keyboards

Carpal Tunnel Savior? Kinesis Tries New Ergonomic Design

BY DON WILLMOTT

Ergonomically correct keyboards are starting to pop up everywhere. Among the more interesting designs available today is that of the Kinesis Ergonomic Keyboard. Priced at $690—the company contends that in this market that's a competitive price, and volume discounts are available—the keyboard arranges the alphabet keys in precisely vertical (not diagonal) columns in two concave depressions. The Kinesis Keyboard also puts the Backspace, Delete, Enter, Space, Ctrl, Alt, Home, End, Page Up, and Page Down keys under your thumbs in the middle and spreads 17 smaller-than-normal function keys across the tops of the two key wells.

Elevating your thumbs turns your hands so they aren't parallel to the keyboard. The bottom of the keyboard acts as a palm rest to support your hand as your fingers type.

There's an embedded ten-key numeric keypad in the right key well, and you can use up to two optional foot pedals for shifting or any other keystroke. The keyboard is programmable, as well.

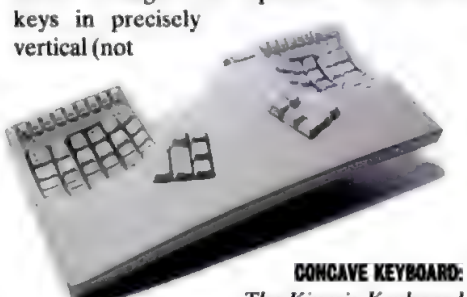
So can you type on it? That's a very subjective question, of course, but the fast answer is yes. Touch typists will find that all the letter keys are in just about the right place, though individual users may feel a particular key isn't sitting right (Kinesis says 8 hours of practice will be enough for most users).

More difficult to get accustomed to are the function keys, which you end up poking rather than pressing. They are, however, closer by than they are on a regular keyboard.

The Kinesis Keyboard will most likely be bought in bulk by organizations, because its price is so high. But anything that might bring down corporate health costs is worth a look.

List price: *Kinesis Ergonomic Keyboard, $690. Kinesis Corp., 915 118th Ave. SE, Bellevue, WA 98005; 206-455-9220; fax, 206-455-9233.*

Circle 425 on reader service card



CONCAVE KEYBOARD: *The Kinesis Keyboard limits unnecessary wrist motion.*

OKIDATA USES 2,560 BURSTS OF LIGHT TO MAKE YOU LOOK BRILLIANT.

If you think all laser printers are mirror images of each other, meet the one that broke the mirror.

•

Okidata® engineers flatly rejected the complex mechanism of rotating mirrors, focusing lenses and whirring motors that every major brand of laser printer depends on for its operation. Instead, they designed a better way – a unique, solid-state LED printhead that precisely positions each one of 2,560 pinpoints of light, to produce a laser printer's brilliant output without a laser printer's built-in complications.

OUR BRILLIANT LED PRINTER LINE-UP INCLUDES THE IMPROVED-RESOLUTION OKIDATA OL810.

Since our solid-state LED printhead has no moving parts, Okidata guarantees it for five full years–the industry's longest. (After all, our printers have a reputation of reliability to uphold.) And we offer a full range of machines that can handle any workload from basic word processing to sophisticated business text and graphics.*

•

To see how Okidata page printers can help make your business look brilliant, call 1(800) OKIDATA for the name of the dealer nearest you. And look brilliant yourself.

CIRCLE 056 ON READER SERVICE CARD

WE DON'T JUST DESIGN IT TO WORK. WE DESIGN IT TO WORK WONDERS.®

OKI OK!

OKIDATA

Print samples created using popular software packages and printed on a range of Okidata LED Page Printers. *5 year limited warranty on LED printhead plus 1 year parts/labor on entire printer. OKIDATA and the OKI OK! are registered trademarks of Oki Electric Industry Co., Ltd. "We don't just design it to work. We design it to work wonders." is a registered trademark of Oki America, Inc.

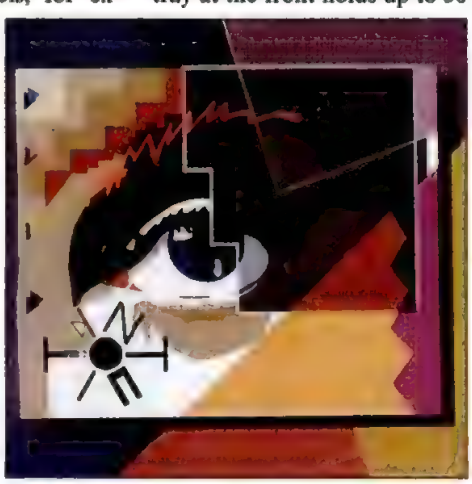
■ Color Printers

Fargo Primera: Colorful Windows Output for $1,000

BY M. DAVID STONE

If you've admired the saturated colors typical of a thermal wax transfer color printer but couldn't justify the price tag of $4,000 and up, then the Fargo Primera Color Printer from Fargo Electronics may be the color printer you're looking for. The Primera delivers thermal wax transfer technology at a list price of $995 (which translates into a street price of $790 to $900), and provides the kind of color quality you won't find elsewhere at this price.

As you might expect, Fargo keeps the Primera's price down primarily by cutting corners. Its front panel controls, for example, consist of only a power button, an on-line button, and a status light for each. And instead of an LCD and built-in menu settings, you'll find a bank of DIP switches on the back for the setting of the few printer defaults. But while the corner-cutting is extensive, it's also judicious, limiting the printer in ways that prove well worth the savings that you enjoy.



BARGAIN COLOR: *The Primera outputs images like this CorelDRAW file out at 200 dpi.*

A WINDOWS PRINTER

The Primera is a Microsoft Windows printer, which means that it comes with a Windows 3.1 driver, so it will work with any Windows program. But the Primera doesn't follow any standard printer language, so you can't expect to use it outside of Windows. If you use Windows programs for all your color graphics, however, this won't be a major issue.

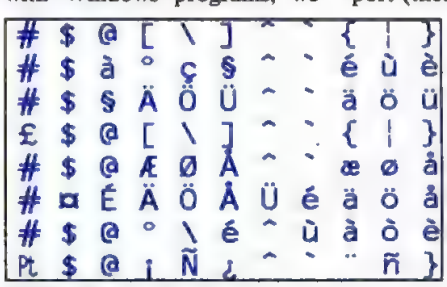
The printer also cuts corners on resolution. Instead of a 300-dot-per-inch (dpi) engine, you get Fargo's own 200-dpi engine. The resulting output leaves jagged edges on curves and on diagonal straight lines, but you have to really look for the jagged edges. And you still get fully saturated colors.

The Primera's engine offers a C-shaped path, and it can handle A, A4, and legal-size paper (with a maximum 8.5-by-9.3-inch image for A and A4 sizes, and 8.5 by 10.8 inches for legal-size sheets). The drop-down paper tray at the front holds up to 50 sheets of paper or 30 transparencies. The output tray holds 30 sheets.

Cost per page can vary from 40 to 57 cents for paper, and from $1.09 to $1.26 for transparencies. Fargo's color ribbons are $45, with 115 images for three-color ribbons, or 80 images for four-color ribbons. Transparencies are about 70 cents per sheet, coated paper about 6 cents per sheet. You can also print on any high-quality laser paper, which is typically 1 to 2 cents per sheet.

COLOR QUALITY

Because the Primera only works with Windows programs, we couldn't run the PC Labs Benchmark Tests. However, we printed from CorelDRAW to get a sense of output quality and print speed. For these tests, we used the three-color ribbon and sample paper and transparency sheets that came with the printer.



SHARP: *Text output shows printer's precision.*

Output was up to the standards for the technology. A close look at some solid black areas showed a blue tinge, but that's not unusual with a three-color ribbon. Other colors showed dithering patterns and, as already mentioned, you can see some jagged edges on curves and diagonal lines. Despite these minor flaws, however, the overall effect is impressive at this price level.

2.5 MINUTES PER PAGE

Speed is hard to judge without formal tests. The engine is rated at 2.5 minutes per page for a three-color ribbon or three minutes per page for a four-color ribbon. In our tests, it took between 3 and 3.5 minutes to print each page directly from CorelDRAW, which is partly a measure of the printer's speed, but is also a test of CorelDRAW, Windows, and the Primera driver.

Note that these times are not directly comparable to PC Labs' normal graphics timing tests; this is because print speed also depends on processing time, and processing time varies with the particular image. Furthermore, the Primera print speed depends on your system. The Primera is the ultimate in dumb printers, which means that it connects through the computer's parallel port (there is no serial port on the printer—another cut corner), and it lets the computer handle all image processing.

Most important, the Primera raises the stakes within the inexpensive color printer market. Until now, the best color technology under $1,000 has been the ink jet, but ink jet colors aren't as vibrant or as saturated as colors from a thermal wax transfer printer. This is particularly obvious with transparencies, where less saturated colors translate into a washed-out look. And if color quality is a key consideration for your needs, the Primera doesn't have any real competition in the under-$1000 class.□

FACT FILE

Fargo Primera Color Printer

Fargo Electronics Inc., 7901 Flying Cloud Dr., Eden Prairie, MN 55344; 800-327-4622, 612-941-9470; fax, 612-941-7836

List price: $995, including one 30-image, three-color ribbon, 25 sheets of paper, five transparencies, Microsoft Windows 3.1 driver.

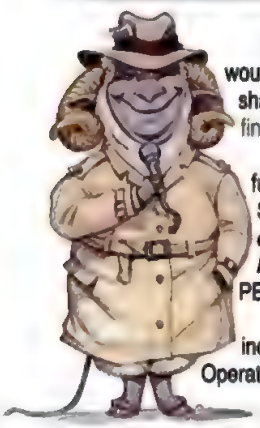
In short: Although limited to 200 dpi and to working with Windows, the Primera offers eye-catching color at less than $1,000, thanks to color wax thermal transfer technology.

415 ON READER SERVICE CARD

Illustration by Jeff Brice/CorelDraw

"LANtastic wrote the book on easy CD-ROM networking"

– ACCESS PENNSYLVANIA



THE BIG SWITCH
INTERVIEW #9

ACCESS PENNSYLVANIA needed a computer network that would allow hundreds of school and public libraries across the state to share CD-ROMs, printers and other peripherals. Their goal was to find one that was reliable, affordable, feature-rich and easy to use.

The ACCESS PENNSYLVANIA Database was organized and funded by the Pennsylvania Department of Education and the State Library. ***"(It) represents the largest CD-ROM union catalogue installation in the world, with more than 1,000 libraries,"*** says Charlene M. Scheib, director of ACCESS PENNSYLVANIA Support.

After months of investigating and testing many systems, including NetWare®, they homed in on the LANtastic Network Operating System.

Why? Ms. Scheib explains: ***"We chose LANtastic for several reasons: LANtastic is cost-effective, easy to install, requires little technical support and provides quick, direct access to CD-ROM mass-storage devices.*** *We see LANtastic as THE network solution not only for libraries of all types, but as* ***the network solution for all purposes."***

For more information, **call 1-800-TINY RAM, ext. 600.** We'll tell you all about the LANtastic networking system, the award-winning leader in peer-to-peer networking for DOS and Windows™ environments. We'll also send you a free demo disk and refer you to the Artisoft Authorized Five Star℠ reseller near you.

AUTHORIZED RESELLER

WHY BUY FROM ARTISOFT?

- FREE unlimited technical support to registered end users and dealers
- 30-day money-back guarantee on all Artisoft™ products
- 5-year limited warranty on all Artisoft hardware

LANTIMES READERS CHOICE 1992

PC MAGAZINE EDITORS' CHOICE April 14, 1992 LANtastic, Version 4.10

PC MAGAZINE 1992 Product of the Year

ARTISOFT

Revolutionizing Connectivity

691 East River Road, Tucson, AZ 85704
Sales/Customer Service 1-800-TINY RAM, ext. 600

© 1992 ARTISOFT, INC. All rights reserved. Artisoft is a trademark, Artisoft Authorized Five Star is a service mark and LANtastic is a registered trademark of Artisoft, Inc. NetWare is a registered trademark of Novell, Inc. Windows is a trademark of Microsoft Corporation.

CIRCLE 254 ON READER SERVICE CARD

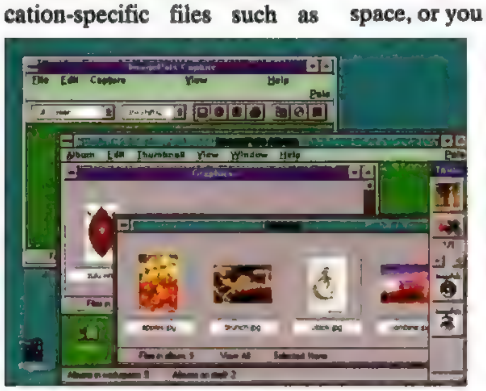
Image Editing

ImagePals 1.2: A Trio of Windows Image Managers

BY BARRY SIMON

If you need to manage large collections of images or capture lots of screens, you'll treasure ImagePals, Version 1.2. With a trio of Microsoft Windows–based utilities called Album, Capture, and Enhancer, ImagePals is a competent package that is stronger in file management than in image enhancement. To make an already solid offering even better, U-Lead Systems is offering the $249 software for only $99 through May.

ImagePals' unique feature is Album, a utility that lets you organize files into your own collections. It supports a variety of bitmapped images, including JPEG and TIFF formats, and now also supports vector images including CGM, .WMF, and .WPG formats. Album can display the images in thumbnail format, and you can add application-specific files such as Word for Windows documents to a collection.



SLIDE SHOW: *ImagePals includes a screen capture module and an image album.*

By assigning descriptions to each image, you can search for images and display only those that meet your criteria. For example, you can search on a specific file type or a simple descriptive word.

DRAG-AND-DROP ACROSS APPS

ImagePals' interface provides quick access to stored images and other applications. Double-clicking on a thumbnail brings up a full-size view, and double-clicking on an application-specific icon launches that application along with a file.

Album acts as a drag-and-drop source both internally and for other programs. You can drag and drop thumbnails to any open application that supports Windows' File Manager's dragging and dropping, such as Micrografx's PhotoMagic. You can also add application launch buttons that act as drag-and-drop targets.

With Capture, ImagePals' powerful screen-capture utility, you can capture, via hotkey or timed delay, all or part of the screen. You can send screens to your printer, to the clipboard or to a file, or to Capture's workspace, or you can automatically drop the file and its thumbnail into a selected album.

Since Capture and Album are linked, dealing with multiple captures is a breeze. Moving images between albums is as simple as grabbing the image with a mouse and moving it between windows. The Album utility is an excellent tool for tracking images that have been archived off-disk or in .ZIP files since thumbnails (which are 5–15K each) are saved on-disk independently of the original. You can even use Album's LZW compression to back up images off-disk.

IMAGE EDITING: *ImagePals' photo editor includes a toolbar and a color selector.*

IMAGE ENHANCEMENT

Enhancer is a solid bitmap editor, although not quite in the same league as Micrografx's PhotoMagic and ZSoft's PhotoFinish, the two best low-priced image editors. Enhancer supports .BMP, .GIF, JPEG, .PCX, .TGA, and TIFF formats, and its Save As command acts as a file-conversion utility. Enhancer imports but doesn't save files in Kodak Photo CD format. It supports black and white, gray scale, 8-bit color (256 colors), and 24-bit color (16 million colors) images, and in this version now works as an OLE server so you can place and edit images in OLE client applications.

Enhancer can rotate images (even through angles less than 90 degrees), flip them, convert them to gray scale or reduce their colors. The basic filters—lighten, sharpen, blur—can act on a selected region or the entire picture, or can be used in a brushlike manner with a "magic finger" tool. Custom filters are limited to mosaic and emboss effects.

You can also view histograms of color usage and adjust highlight, midtone, and shadow for a smooth effect, although you can't drag the response curve for finer control. Other than a gamma correction tool, there are no tools to calibrate scanned or displayed images.

Excellent scanner support encompasses Twain (a standard for scanner input) as well as drivers for leading scanners. With the stitch tool, you can assemble scans from multiple passes. On our tests, the completely automated stitching tool worked poorly, but the new "auto fine tune" option, in which you stitch by eye and let the ImagePals program make adjustments, worked wonderfully.

Enhancer is weak in a few areas. It offers a single straight-line drawing tool, and its new clone feature works only within an image and not between two images. Enhancer has no status line to indicate what the toolbar buttons do, and its on-line help is meager.

Overall, however, ImagePals' flexible image-management tools, solid screen-capture program, and intelligent use of the Windows interface make it a worthy graphics tool. □

FACT FILE

ImagePals, Version 1.2

U-Lead Systems, 970 W. 190th St., #520, Torrance, CA 90502; 800-858-5323, 310-523-9393; fax, 310-523-9399

List price: $249 (introductory price through May, $99); upgrade, $29.
Requires: 2MB RAM (4MB recommended), 3MB hard disk space, Microsoft Windows 3.0 or later.
In short: A linked set of Windows-based utilities for those who need to manage graphical files. Album is a file organizer; Capture is a powerful screen capture; and Enhancer is a solid bitmap editor.

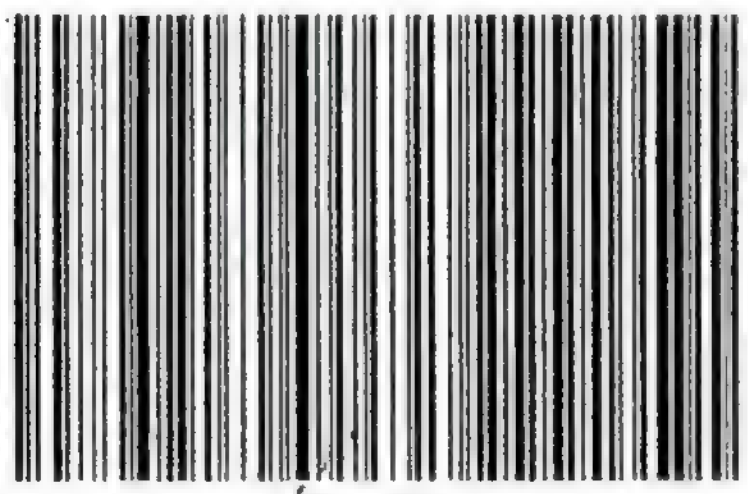
418 ON READER SERVICE CARD

What Do You Wish For In A PC?

GATEWAY2000

Inverted Back

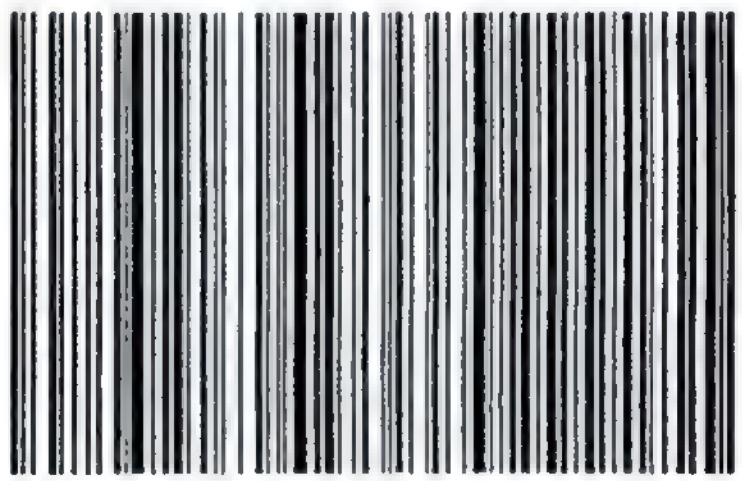
1. Follow instructions on the other side



Back

1. Follow instructions on the other side

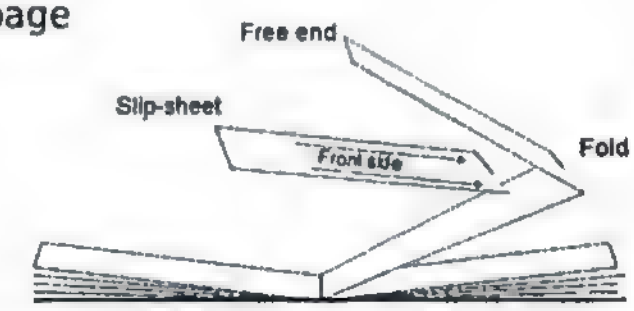
Folded edge of the page



GbsSlipSheet-001

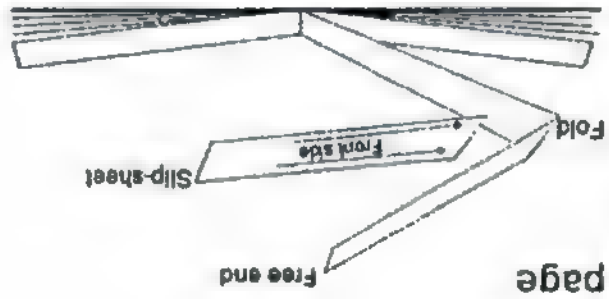
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

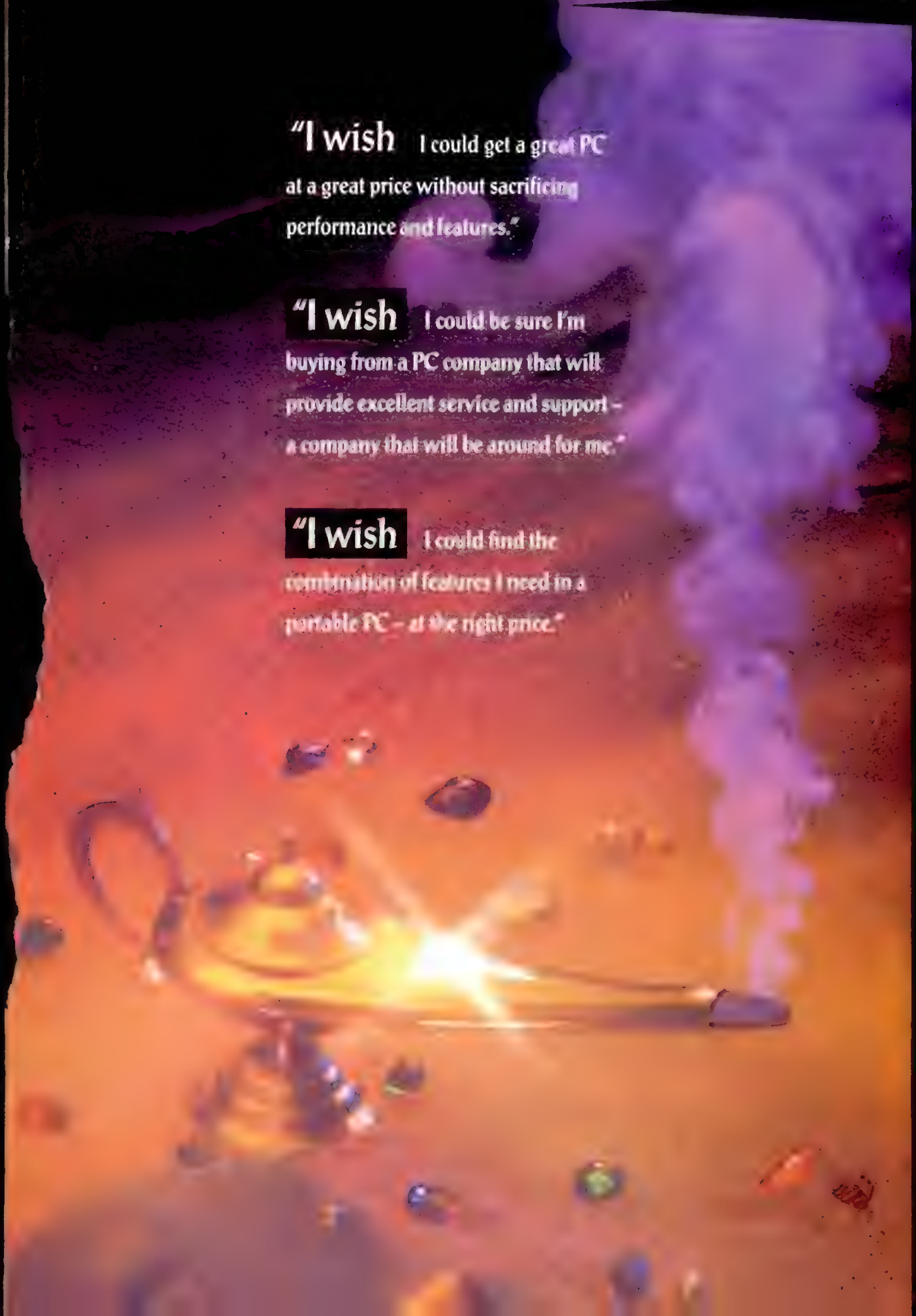


Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Your Wish Is Our Command!


"I wish I could get a great PC at a great price without sacrificing performance and features."
"I wish I could be sure I'm buying from a PC company that will provide excellent service and support – a company that will be around for me."
"I wish I could find the combination of features I need in a portable PC – at the right price."

Your wish is our command at Gateway 2000! We can grant you the three most universal PC wishes in the wink of an eye. As a fringe benefit, we won't limit you to three wishes here. Most anything your heart desires in computers (sorry, we can't grant wishes for romance or riches), you can get from Gateway.
That's because we built our business by listening to our customers' wishes and doing everything in our power to make their dreams come true. At Gateway, we believe you should be able to *have it all*: the latest technology, glittering performance, quality construction, enchanting service and the fairest prices in the land. All this from a financially healthy company that won't run dry and leave you stranded in the desert.
You don't have to settle for less. With Gateway 2000, you can have it all. Draw up your wish list and give us a call. We'll make some truly magical values materialize for you.
GATEWAY2000

Gateway Grants You The Most Wond

"I wish I could get a great PC at a great price without sacrificing performance and features." Your wish is our command!

You'll be spellbound by Gateway's ferociously competitive prices on systems that are unequaled in powerful performance, impressive features and graceful integration of components. Other companies make the same claims, but the truth is revealed when readers and editors of the most popular PC magazines are asked which company delivers on its promises. Their overwhelming response is Gateway 2000.

"Gateway has gone far beyond conventional ideas of price and performance. In doing so, it has created new rules that other PC makers will have to follow if they want to remain players."

– *PC Computing*, 1992 MVP Awards

"Gateway 2000 was the big 1992 Best Buy winner, sweeping not only the desktop awards as it did last year, but the newly expanded notebook categories as well ... Altogether, Gateway won five Best Buy awards this year, including Best Overall System Vendor ... It's no surprise that Gateway is consistently the people's choice when it comes to systems. Its formula for success is to sell fully configured PCs at aggressive, how-can-they-do-that prices, along with comprehensive service and technical support."

– *Computer Shopper*, 1992 Readers' Best Buy Awards

ous Value In The Land.

"Gateway not only captured the title for best desktop, it also got the nod for best service and support and ranked in the top five for portables, notebooks, most promising newcomer and best mail-order firm."

– *PC World*, 1992 Readers' Choice Awards

"I wish I could be sure I'm buying from a PC company that will provide excellent service and support – a company that will be around for me." Your wish is our command!

Twice in 1992, Gateway was honored for outstanding service. *PC World* readers ranked Gateway number one in service and support. And *PC Magazine* readers gave Gateway the best overall scores in the 1992 Service and Reliability Survey.

Just as important is our strength as a company. Warranties and assurances of lifetime technical support don't mean anything unless a company survives to honor them, which is a serious consideration in the shifting sands of today's PC marketplace.

Gateway is among the few financially robust companies in the industry. Our 1992 revenues exceeded $1 billion and our earnings are among the strongest in the industry. The company is virtually debt-free. At a time when other companies have been forced to lay off employees, we added 300 people to our staff. You now have 1,800 friends in the business. Rest assured Gateway is your oasis that will never leave you high and dry. We'll be here for you!

GATEWAY2000

800-846-2000

For The Nomad In You.

"I wish I could find the combination of features I need in a portable PC – at the right price." Your wish is our command!

No matter what you need in a portable, you'll find it in one of our Nomad notebooks. Gateway customers selected Nomads as the winners in 386 and 486 notebook categories of *Computer Shopper's* 1992 Best Buy Awards.

"There are faster laptops, there are cheaper laptops, there are color laptops, but there is no better laptop ... Weighing in at only 5.6 pounds, the Nomad combines the powerful punch of a 25MHz i486DX with a working battery life of more than six hours. At long last, we have a laptop that can really go the distance when there's no power outlet in sight."

– *Computer Shopper*, 1992 Readers' Best Buy Awards

PC Sources echoed *Computer Shopper's* conclusions. "The Nomad 425DXL packs an awful lot of computing into a case that's just 1.7 inches high. Its excellent 79-key keyboard has a great typing feel ... The fine video system includes a large backlit black-on-white LCD ..."

New this month is the Nomad 450DXL including Intel's 50MHz 486DX2L processor for blazing performance.

Our Caravan Of Extras.

Software Selections

Your every software need is our command. With mini desktop, desktop and tower systems that include "choice of application software," select one of the following applications, all latest versions:

- Microsoft® Excel for Windows™
- Microsoft Word for Windows™
- Microsoft Word and Bookshelf 92,® CD-ROM Edition
- Microsoft PowerPoint for Windows™
- Microsoft Project for Windows™
- The MS Entrepreneur Pack (Works,™ Publisher,™ Money,™ TurboTax for Windows® from ChipSoft, and games)
- Borland Paradox® or dBASE IV®
- The Windows Programmer Pack (MS Quick C,™ Visual Basic and more)
- Upgrade to Microsoft Office™ for $175

If the system you want comes with Works for Windows,™ you can upgrade to one of the software choices above for only $150.

Utilities Included, Too

Cool Tools for DOS, a diagnostic and utilities package, comes with all Gateway desktop systems and includes: QA Plus™ from Diagsoft,™ Central Point® Anti-Virus, RAM Boost, Defrag and Emergency Disk.

Microsoft Windows™ for Workgroups

Windows for Workgroups is ideal for e-mail, group scheduling and resource sharing, and includes an Ethernet adapter and software. Hardware and software are factory-installed. You can see Windows for Workgroups running on Gateway systems in any of over 200 Egghead Software® stores in the U.S. Stop by for a demonstration! With the purchase of a system, Windows for Workgroups is specially priced at just **$159**!

Microsoft Windows Sound System™

This sound system designed especially for business use lets you speak to your PC for hands-free operation. It even reads numbers back to you for proofing. You can also embed audio messages in all your Windows OLE applications. Package includes soundboard, microphone, headset and software. You pay only **$149** with the purchase of a system.

CD-ROM Kit

Includes CD-ROM,interface card and everything you need to add MPC-compliant CD-ROM to your PC. With a system purchase, or if you own a Gateway system, you can buy this CD-ROM kit for only **$225**!

The TelePath™ Fax/Modem

A 14,400bps modem, V.32bis, with 9,600bps fax capability. Includes WinFax Pro,™ Crosstalk™ for Windows, Qmodem™ and more. **$195**

CrystalScan™ 15-Inch Monitor

Non-interlaced 15-inch color monitor with flat, square screen – an upgrade option only at the time of purchase on any Gateway 2000 desktop system for only **$100**.

Panasonic Color-Capable Printer

Add color to your documents with this Panasonic KXP2123 24-pin dot matrix printer. Includes Adobe Type Manager.® Printer, **$259**; Color Option, **$50**

Most Gateway peripherals are sold only with the purchase of a Gateway system. For details on our complete line of components, peripherals and software, call direct to our special add-on components division at ***800-846-2080.***

GATEWAY2000

800-846-2000

Gateway 2000's Magical Values

DESKTOP SYSTEMS

3SX-33

- 33MHz 386SX Intel® Processor*
- 4MB RAM
- 5.25" & 3.5" Diskette Drives
- 80MB 17ms IDE Hard Drive
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan™ 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey™ Keyboard
- MS-DOS,® Windows™ & Mouse
- Cool Tools for DOS
- MS Works for Windows™ 2.0

$1295

4SX-25

- 25MHz 486SX Intel Processor*
- 4MB RAM
- 5.25" & 3.5" Diskette Drives
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- MS Works for Windows 2.0

$1495

4SX-33

- 33MHz 486SX Intel Processor*
- 4MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$1695

4DX-33

- 33MHz 486DX Intel Processor*
- 4MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 250MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$1995

4SX-33V

- 33MHz 486SX Intel Processor*
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 170MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$2195

4DX-33V

- 33MHz 486DX Intel Processor*
- 8MB RAM, 64K Cache
- 5.25" & 3.5" Diskette Drives
- 250MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$2495

4DX2-66V

- 66MHz 486DX2 Intel Processor*
- 8MB RAM, 256K Cache
- 5.25" & 3.5" Diskette Drives
- 340MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- VESA Local Bus ATI Ultra Pro with 1MB VRAM
- 15" Color CrystalScan 1572FS
- Desktop Case (Tower Upgrade)
- 8 16-Bit ISA Slots, 2 with 32-Bit VESA Local Bus
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$2995

4DX2-66E

- 66MHz 486DX2 Intel Processor*
- 8MB RAM, 256K Cache
- 5.25" & 3.5" Diskette Drives
- 500MB 11ms SCSI Hard Drive
- 32-Bit EISA SCSI Controller
- Windows Accelerated Video with 1MB DRAM
- 14" Color CrystalScan 1024NI
- Tower Case
- 8 32-Bit EISA Slots
- 124-Key AnyKey Keyboard
- MS-DOS, Windows & Mouse
- Cool Tools for DOS
- Choice of Application Software

$3795

486 Notebooks

NOMAD 425SXL

- 25MHz 486SX Intel Processor*
- 4MB RAM
- 3.5" Diskette Drive
- 80MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 256K
- Size 8.5" x 11" x 1.8", 5.6 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse™
- MS-DOS 5.0 and Windows 3.1
- MS Works for Windows 2.0

$1995

NOMAD 425DXL

- 25MHz 486DX Intel Processor*
- 4MB RAM
- 3.5" Diskette Drive
- 120MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8", 5.6 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse
- MS-DOS 5.0 and Windows 3.1
- MS Works for Windows 2.0

$2595

NOMAD 450DXL

- 50MHz 486DX2 Intel Processor*
- 8MB RAM
- 3.5" Diskette Drive
- 200MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8", 5.6 Lbs.
- 6-Hr. NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard & FieldMouse
- MS-DOS 5.0 and Windows 3.1
- MS Works for Windows 2.0

$3295

GATEWAY2000

"You've got a friend in the business"

800-846-2000

610 Gateway Drive • P.O.Box 2000 • North Sioux City, SD 57049-2000 • 605-232-2000 • Fax 605-232-2023

Sales Hours: 7am-10pm Weekdays, 9am-4pm Saturdays (CT)

**Contains an Intel386™ or Intel486™ microprocessor*

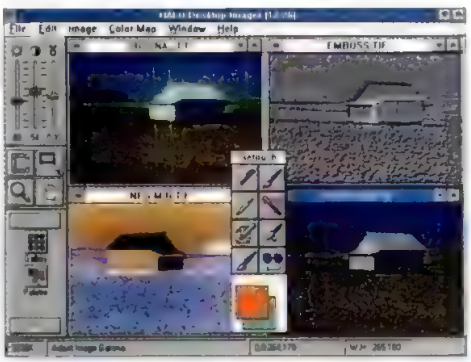
©1993 Gateway 2000, Inc. AnyKey, HandBook, FieldMouse, CrystalScan and TelePath are trademarks of Gateway 2000, Inc. The Intel Inside Logo is a trademark and Intel is a registered trademark of Intel Corporation. All other brands and product names are trademarks or registered trademarks of their respective companies. Prices and configurations are subject to change without notice. Prices do not include shipping.

Windows Image Processing

HALO 2.0 Adds Image Gallery to Complete Graphics

BY J.W. OLSEN

Not complacent with success, Media Cybernetics has added powerful enhancements to the already robust HALO Desktop Imager, an Editors' Choice from our last evaluation of image processors ("Capture and Conversion the Windows Way," June 16, 1992. Version 2.0 retains the competitive $139 list price while meeting the image processing needs of Microsoft Windows users. Though it's not all things to all users, HALO 2.0 may well meet your current needs and still have plenty of room to grow.



CUSTOM IMAGES: *HALO's new retouching tools.*

HALO 2.0's basic functions are intuitive and inviting. Happily, the File Open command now recognizes all of the ten graphics formats it supports. Version 2.0 adds the JPEG format, but if you prefer to use other than the default TIFF format, you must reset the default each time.

HALO 2.0 now sports a comprehensive set of image retouching tools. Also new is text annotation that will superimpose words onto images.

Windows 3.1 users will appreciate Version 2.0's full OLE support, which lets you integrate HALO 2.0 files into other applications, while graphics pros will delight in the new Gallery image manager. Galleries help you remember long-forgotten images by organizing mini-ature copies of related files in collections which can be displayed like a photo album. The primary image files may span directories—even on a network— and contain a combination of formats. Scan a Gallery, double-click on a miniature image, and HALO 2.0 loads the related file for you.

HALO 2.0 now supports all Kodak Photo CD formats, but to capture your own images from a full-screen DOS task, you are still required to look elsewhere—perhaps to Media Cybernetics' $139 Dr. HALO IV Paint and Imaging Pak.

Another of HALO 2.0's weaknesses is its continued inability to display an image on a full screen, as competitors Clip and Save, ImagePrep, and Paint Shop Pro can. This is particularly annoying since HALO 2.0's title bar and other screen elements hog screen real estate, requiring extensive panning of even medium-size images. This problem is only partially offset by good panning capability.

Also noteworthy are HALO 2.0's color editor, its ability to rotate images in single-degree increments, and its color-separating tools for preparing images for commercial printing. Color may be manipulated in RGB, HSV, HSI and CMYK models.

If your primary need is screen capturing for documentation or similar purposes, you may prefer other packages. Otherwise, it's hard to beat HALO 2.0, especially if versatile image manipulation is paramount.

• List price: *HALO Desktop Imager, Version 2.0, $169.* Requires: *2MB RAM (3MB recommended), 2MB hard disk space, Microsoft Windows 3.0 or later. Media Cybernetics Inc., 8484 Georgia Ave., Silver Springs, MD 20910; 800-992-4256, 301-495-3305; fax, 301-495-5964.*

Circle 423 on reader service card

Flow Charting Software

ABC FlowCharter Offers the Allure of Organization

BY ANGELA GUNN

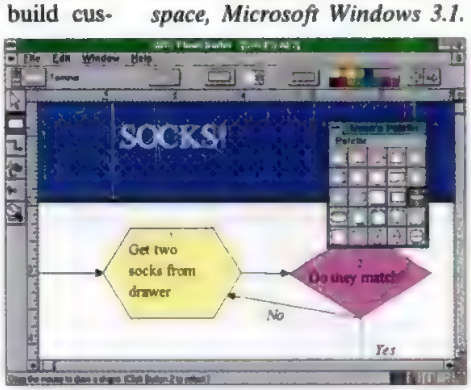
Flowcharts were once considered the tools of programmers, who needed a means of keeping track of complex processes. Of course, everyone has a few complex processes in his or her line of work, whether they involve programs or personnel. Although it may seem to target a niche market that might be served by a drawing or charting package, Micrografx's $495 ABC FlowCharter, Version 2.0, has flexibility and ease of use that make it extremely helpful for anyone who needs to organize workflow data.

FlowCharter resembles a drawing package with an unusually large collection of shapes. The shapes, which comprise most of the traditional flowcharting forms, are connected by various lines. The package lets you label each shape, build multipage charts, and reorganize chart designs easily.

FlowCharter's excellence is in its details. Shapes can be created and automatically connected to the chart by dragging the mouse from one shape to a new location. Shapes are automatically numbered, though this feature can be switched off.

The package is designed for non-artists: Several line styles are available, each appropriate for charts of different sizes and complexity and all capable of correcting for sloppy freehand drawing. Text and lines are automatically connected to shape at predetermined spots. Those with design skill can adjust all the specifications, build customized palettes and chart templates, and import vector and bitmap shapes and graphics of their own. OLE links make the package even more useful.

The package, which was originally released in 1989 by Roykore, has been redesigned to adhere to the Micrografx interface used by Picture Publisher and Windows Draw. Though this package clearly fills a smaller market need, it's definitely a worthy option for any manager who's ever felt the need for a little organization.



GO WITH THE FLOW: *Combine its own shapes, colors, and lines with your artwork.*

• List price: *ABC FlowCharter, Version 2.0, $495.* Requires: *2MB RAM, 1.7MB hard disk space, Microsoft Windows 3.1. Micrografx Inc., 1303 Arapaho, Richardson, TX 75081; 800-733-3729, 214-234-1769; fax, 214-994-6475.*

Circle 422 on reader service card

Windows CAD

TurboCAD for Windows Improves on DOS Sibling

BY JOSEPH DESPOSITO

TurboCAD 3.0 users looking for more CAD power and a chance to do their work in Microsoft Windows will welcome TurboCAD Professional for Windows, Version 1.0. The price and features of IMSI's new package will also attract many other 2-D CAD users who want to move over to Windows. At $395, TurboCAD Professional is more than double the price of the DOS version, but it's positioned well below the price of most Windows CAD products.

TurboCAD Professional's Windows implementation is creative—making splendid use of the cursor, icons, and buttons—but sometimes nonconventional. The default cursor is a "hot cursor" that tells you the name of each icon it touches. A set of icons appears in a vertical column on the left-hand side of the screen.

Icons are available for drawing lines, circles, and arcs. When you click on the top icon (called the parent), a second set of icons appears. Clicking on any of these replaces the original set. The parent icons correspond to the menu bar at the top of the screen; the child icons correspond to the pull-down menu choices. For each menu choice or icon, there is also a corresponding hotkey.

SCREEN OF BUTTONS

TurboCAD Professional makes lavish use of buttons on the screen. You can quickly change many of the drawing defaults, including units of measurement, scale, colors (16 to choose from), and line types. A three-button mouse works best with the program, but if you have a two-button mouse, on-screen buttons come to the rescue.

A status area along the bottom of the screen plays a crucial role in the drawing process. As you make selections, the status area informs you of any information the program needs. If you don't pay careful attention to this area, you can become confused quickly. For example, when you open a file, no drawing appears on the screen at first. To see the drawing, you must first answer a prompt for *x* and *y* offsets that appears in the status area.

TurboCAD Professional for Windows, Version 1.0
IMSI, 1938 4th St., San Rafael, CA 94901; 800-833-4674, 415-454-7101; fax, 415-454-8901

List price: $395.
Requires: 4MB RAM, 4MB hard disk space, Microsoft Windows 3.0 or later.
In Short: A fine choice for current TurboCAD users who need more power and want to switch to Windows.
419 ON READER SERVICE CARD

Experienced Windows users will find some of the file commands disconcerting. For example, the Open command is really a merge command. And the New command is really a clear screen command. If you are not careful, you can easily load one drawing onto another, or lose a drawing inadvertently.

TurboCAD Professional for Windows improves on the DOS version in several ways. One is the inclusion of the Drafting Programming Language. This lets you automate the drafting process with a high-level BASIC-style programming language. The language includes I/O, string manipulation, assignment, branching, and other kinds of statements, as well as subroutine calls and looping operations.

Another improvement is in the importing and exporting of files. TurboCAD Professional can import and export .DXF, IGES, and .INT (TurboCAD for DOS) files. Other added features include programmable hotkeys, dimensioning features, and ASCII text import.

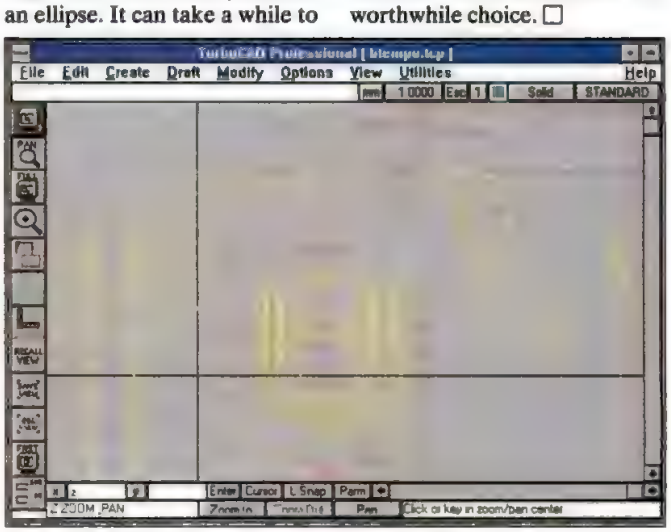
The Windows interface makes drawing a snap in most cases. To draw a line, you simply click on the line icon and start to draw. Sometimes, however, things aren't as straightforward. For instance, when you click on the ellipse icon, a keyboard icon appears on the screen and you are prompted to enter a number for the major radius of the ellipse. This happens only if you click on the ellipse icon with the left mouse button. If you click on the icon with the right mouse button, you get to draw a rectangle that eventually produces an ellipse. It can take a while to get accustomed to these different drawing scenarios.

SYMBOL LIBRARIES COMING

Although improving on the DOS version, TurboCAD Professional for Windows does lack some elements of that version. Notably missing are any symbols or optional symbol libraries, though these will be available in late spring at approximately the same prices as those of the DOS version. Also missing are an on-screen tutorial and a reference card. Like the DOS version, this version doesn't require a math coprocessor, although one is recommended.

There were a few minor trouble spots in the version of the program we tested. The arrow cursor flickered whenever it was placed in the upper-left-hand side of the screen, and the coordinate display sometimes jumped to fantastically high numbers for no reason. In both cases, fixes have been made, according to the company.

TurboCAD Professional is an attractive addition to the Windows CAD market. For current TurboCAD users looking for a path to Windows, it's a logical upgrade. For other 2-D CAD users who want Windows and don't mind the little nonstandard interface quirks, TurboCAD Professional for Windows is an affordable and worthwhile choice. □



TOOLS UP FRONT: *TurboCAD Professional for Windows puts common CAD functions on a convenient button bar.*

See your dealer or call now, 1-800-336-6464, ext. 6506

In Canada, call 1-800-461-3327.

Borland
Power made easy

Copyright © 1993 Borland International, Inc. All rights reserved. All Borland product names are trademarks of Borland International, Inc. Quattro Pro for Windows has patent pending. Offer good in the United States and Canada only. All prices are in U.S. dollars. BI 5340

CIRCLE 287 ON READER SERVICE CARD

Windows Acceleration

Diamond and NDI Cards Use VL-Bus for Fast Performance

BY BEN MYERS

Local-bus video has been a hot issue in the PC industry ever since the first proprietary local-bus systems were shown at Fall Comdex 1991, nearly 18 months ago. Approved by the Video Electronic Standards Association (VESA) members in August 1992, the VL-bus specification recognizes the inherent limitations of the Industry Standard Architecture (ISA) bus, just like the earlier Extended Industry Standard Architecture (EISA) did.

But VL-bus equipment is relatively inexpensive to build compared with EISA, and unlike EISA, the VL-bus has the good fortune of timing on its side. Though rated at a theoretical data-transfer capacity of 33 megabytes per second, EISA hasn't caught on with video card manufacturers.

Relatively few high performance EISA add-in cards have been designed, and EISA has captured neither the minds nor the pocketbooks of most desktop PC buyers. The more costly EISA motherboards and add-in cards require specialized EISA bus chip sets. Even original EISA-consortium members like NEC and Zenith now build more cost-conscious ISA bus systems as well.

TWO VL-BUS CARDS

Now there is a pair of 32-bit graphics cards that unleash the promise of local bus, yet exploit the open VESA VL-bus.

The Diamond Viper VLB, a $549 card propelled by a Weitek Power 9000 graphics chip, is the speedier and more expensive of the two, and it comes preconfigured with 2MB of 70-nanosecond video RAM. Though the card is priced low compared with today's high-end graphics cards (which cost around $1,000), it rivals their high-end performance. It's intended for users of Windows and AutoCAD only, since no other drivers are provided with the card.

The NDI Volante Warp 10LB, at a more modest $299, yields performance that still exceeds that of most ISA bus graphics cards. The Volante Warp 10LB is powered by S3's 86C805 graphics chip, a local-bus kissing-cousin of the 86C801 chip, the force behind NDI's ISA-bus Warp 10 (First Looks, December 8, 1992). The card is equipped with 1MB of less expensive 60-ns dynamic RAM and is socketed for expansion up to 2MB of on-board memory.

Installation of both VL-bus add-in cards is a bit demanding, because there are three edge connectors that need to be lined up with a motherboard slot. The procedure is exacerbated by the uneven forces that you must apply. The relatively coarse pair of ISA edge connectors on one end of the card slide easily into their slots, but the fine MicroChannel-like VL edge connector needs a hard push to get seated properly in its slot. ISA and EISA bus cards have a less daunting pair of edge connectors (see the sidebar "VL-Bus Cards: Install Carefully").

DRIVER TOUCH UPS

Though the cards are good performers, their Windows software and drivers need added touches to operate more smoothly. For example, the Viper VLB uses its own program to change resolution, number of colors, or system font size, but it doesn't install a convenient point-and-click icon to run it. Instead, you must run the Viper's install program again. And the initial documentation for the Viper VLB doesn't correctly describe where all of its software is installed.

Neither card provides utility

Graphics Winmark Test

The Diamond Viper VLB and the NDI Warp 10LB, two local-bus video accelerators, both improve on Windows' video performance. The Diamond board does it with Weitek's Power 9000 chip and 2MB VRAM, while the NDI board is based on the S3 86C805 chip and 1MB DRAM.

The Graphics Winmark is the mean of 12 Winbench graphics tests, measured in megapixels per second. The Winmark score takes into account tests of 12 key video functions and weights them to reflect how frequently the functions are used. Higher scores represent better performance.

VL-Bus Cards: Install Carefully

With more and more 32-bit peripheral chips available on one side of a PC's bus and a very fast 80486 processor on the other, the ISA bus has become a very slender bottleneck.

A VL bus provides a direct 32-bit data path between the 486 chip and up to three add-in cards. Its speed is the same as that of the processor, up to a limit of 40 MHz. It adds a third edge connector to a card, in line with the standard pair of ISA or EISA bus slot connectors. The spec also calls for VL-bus cards to have beveled edge connectors.

Experience with a large number of VL-bus cards seems to be showing that many early cards have been improperly machined at the factory. They have edge connectors with dead square corners, contrary to the VL-bus spec. The square corners of an add-in card can cause damage to a VL-bus motherboard in several ways. First, you need far more force to insert a square connector into a slot than a connector with slightly beveled corners. Applying excessive force to a motherboard can crack it or otherwise render it inoperable. Then, when you remove a card with square corners from a slot, it's very easy for the sharp point of a square corner to catch a fragile wire inside a slot, potentially damaging the slot and the motherboard.

RADICAL SOLUTION

One solution is frowned upon by most graphics card manufacturers, but it is simple and remarkably effective. You can use a very fine and small file, like the one found on a Swiss Army knife, to round the corners of the connectors slightly. This has to be done with extreme caution, without filing away or otherwise damaging the electrical contacts on the card. After just a little bit of filing, a previously square VL-bus card installs more smoothly.—*BM*

software to adjust the timings of your monitor interactively, so you may find the image displayed on-screen to be off-center or incorrectly sized. However, if your monitor has manual switches to change the size or positioning of the image you will be able to work around this problem with no trouble.

With the Viper VLB, Diamond includes Halo Desktop Imager software, an image editor; and Turbo Display List Driver for the AutoCAD family. In addition to its Windows drivers, the Volante Warp 10LB includes software drivers that have become somewhat standard: AutoCAD, GEM/Ventura Publisher, Lotus 1-2-3, Microsoft Word for DOS, WordPerfect for DOS, and several CAD packages.

VIDEO PERFORMANCE

The Viper VLB turned in a Graphics Winmark score of 27.5 million and a throughput test score of 15.3 million pixels per second with the Image Blit test in PC Magazine Lab's Winbench 3.11 (on a 33-MHz 486 at 1,024-by-768 resolution with 256 colors).

Because the Viper VLB uses VRAM memory, its performance halved and then halved again when run at 65,536 colors and 16 million colors, in line with theoretical expectations. Still, when set up to display the 16 million colors of true color, the Viper VLB remained quite nimble in operation.

The Volante Warp 10LB yielded a Graphics Winmark score of 10.4 million and had throughput score of 15.0 million pixels per second on the same test. Its performance tailed off more sharply at greater color depth than the Viper VLB did, since the Volante Warp 10LB uses DRAM memory—thus stealing cycles from the entire system to keep the on-screen image refreshed.

The Viper VLB goes up to 800-by-600 resolution with 16 million colors, and up to 1,024-by-768 resolution with 65,536 colors. The Volante Warp 10LB has a full range of resolutions with 16 colors, offers a maximum 800-by-600 resolution with 65,536 colors, and 1,024-by-768 resoltion with 256 colors.

INTERESTING CONTRAST

The Viper VLB and the Volante Warp 10LB present an interesting contrast. Though they both crank up graphics performance compared with ISA-based alternatives, the Viper VLB focuses its high speed on Windows and AutoCAD, while the Volante Warp 10LB is broader based in its software support. Either one of these cards will give you much more responsive Windows graphics.

Meanwhile, the VL-bus standard won't remain at a standstill. Faced with the challenge of the Personal Computer Interconnect (PCI) backed by Intel, the VESA VL-bus committee is working on a revision that extends the bus to 64 bits and accommodates Intel's forthcoming Pentium chip. While this new round of bus wars settles out, early adapters of the VL bus can expect to reap the benefits of peripheral performance that doesn't hamstring today's 486-based systems.

- List price: *Viper VLB, $549. Diamond Computer Systems Inc., 1130 E. Arques Ave., Sunnyvale, CA 94086; 408-736-2000; fax, 408-730-5750.*

Circle 427 on reader service card

- List price: *Volante Warp 10LB, $299. National Design Inc., 1515 Capital of Texas Hwy. S., 5th Fl., Austin, TX 78746; 800-253-8831, 512-329-5055.*

Circle 428 on reader service card

CD-ROM Drives

Micro Solutions' No-Slot CD-ROM Drive Runs Through Parallel Port

BY TIN ALBANO

You may be among the millions of PC users who have considered buying a CD-ROM drive but have hedged because of your fear of installing it or your unwillingness to sacrifice an internal expansion slot. While Micro Solutions Computer Products' $499 backpack CD-ROM may not be the fastest CD-ROM drive around, it offers the convenience of a plug-and-play interface that eliminates the need for space-consuming SCSI devices and the ungainly installation routines usually associated with CD-ROM drives.

The backpack CD-ROM implements the same technology found in Micro Solutions' floppy disk– and tape-backup drives to attach to any PC through the parallel port. You never have to open up the computer, and your printer attaches directly to the backpack CD-ROM. The drive has an average access time of 350 milliseconds and a maximum transfer rate of 150 kilobytes per second. Not bad, considering that the $814 NEC InterSect CDR-74, the fastest CD-ROM drive that PC Labs has tested ("CD-ROM Drives: Mass Appeal," December 22, 1992), has an average access time of 280 ms and a 300-KBps transfer rate.

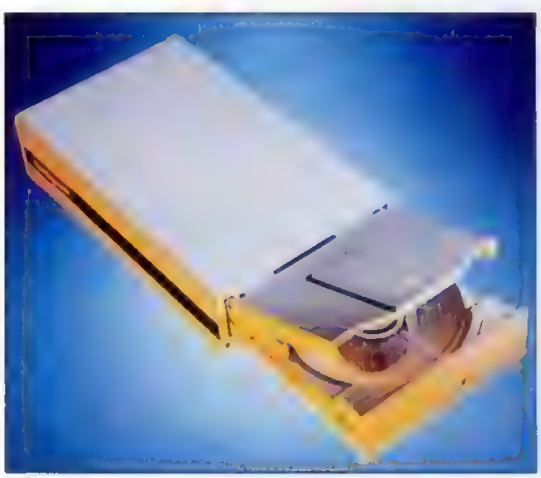
Once plugged in, a simple installation program loads the backpack CD-ROM's system drivers and automatically configures both AUTOEXEC.BAT and CONFIG.SYS files. Although the backpack CD-ROM doesn't meet multimedia standards (it can't support a 150 KBps transfer rate using only 40 percent of the CPU's resources), it has few problems running most multimedia titles. Also, the majority of nonmultimedia titles we tested ran smoothly, with acceptable delay times.

Because of its plug-and-play interface, the 4.9-pound backpack CD-ROM can be transferred between PCs and laptops in a matter of minutes. It's also multisession-compatible and will let you take advantage of Kodak Corp.'s Photo CD technology.

If the ultimate in CD-ROM speed is what you're after and you've got the slot to spare (or if you're trying to build a truly multimedia-compatible PC), you should look elsewhere. But if you want the advantages of a CD-ROM and are unwilling to put up with the problems that installation may pose, the backpack CD-ROM is a great compromise.

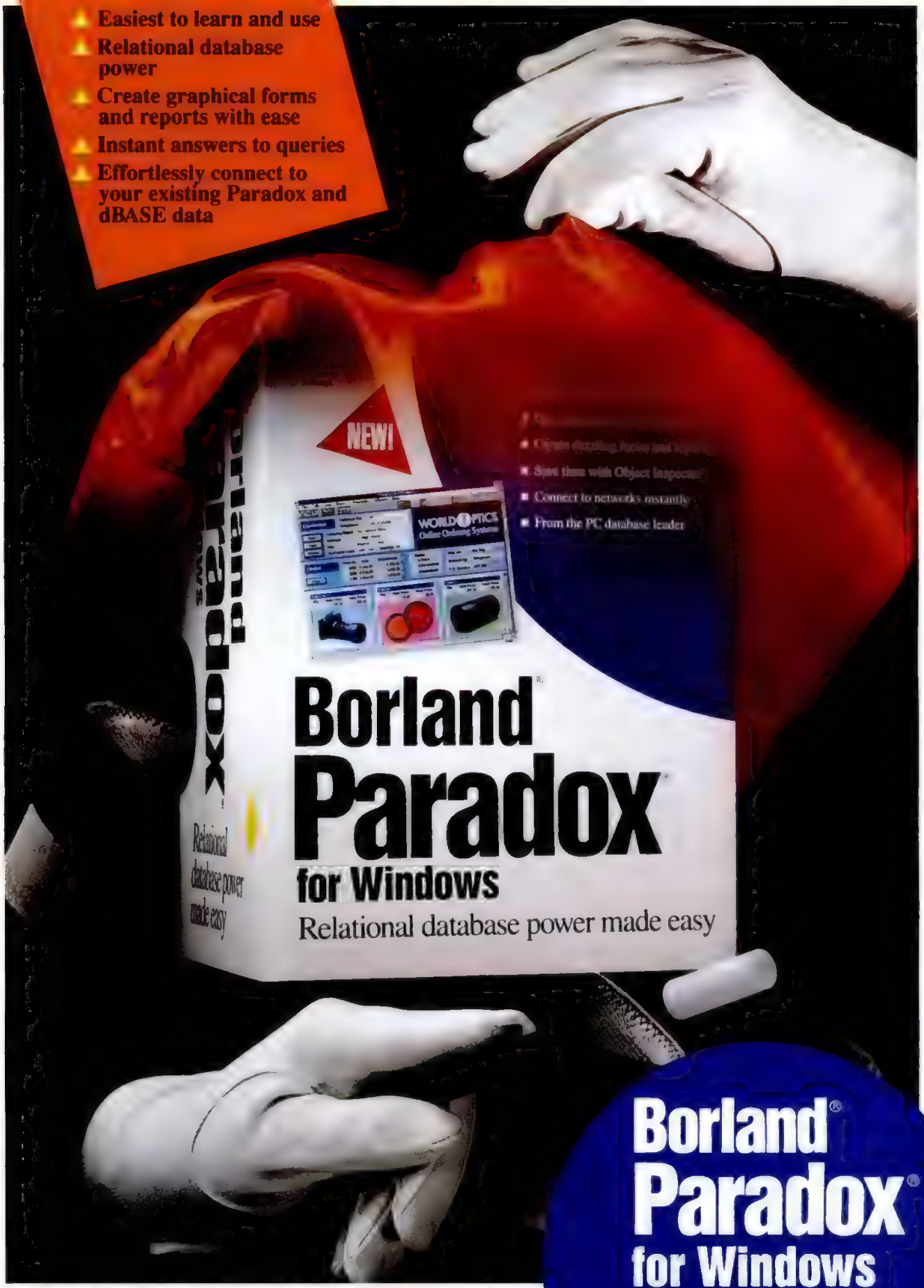
- List price: *backpack CD-ROM, $499. Requires: DOS 3.1 or later, parallel port. Micro Solutions Computer Products, 132 W. Lincoln Hwy., DeKalb, IL 60115; 815-756-3411; fax, 815-756-2928.*

Circle 426 on reader service card



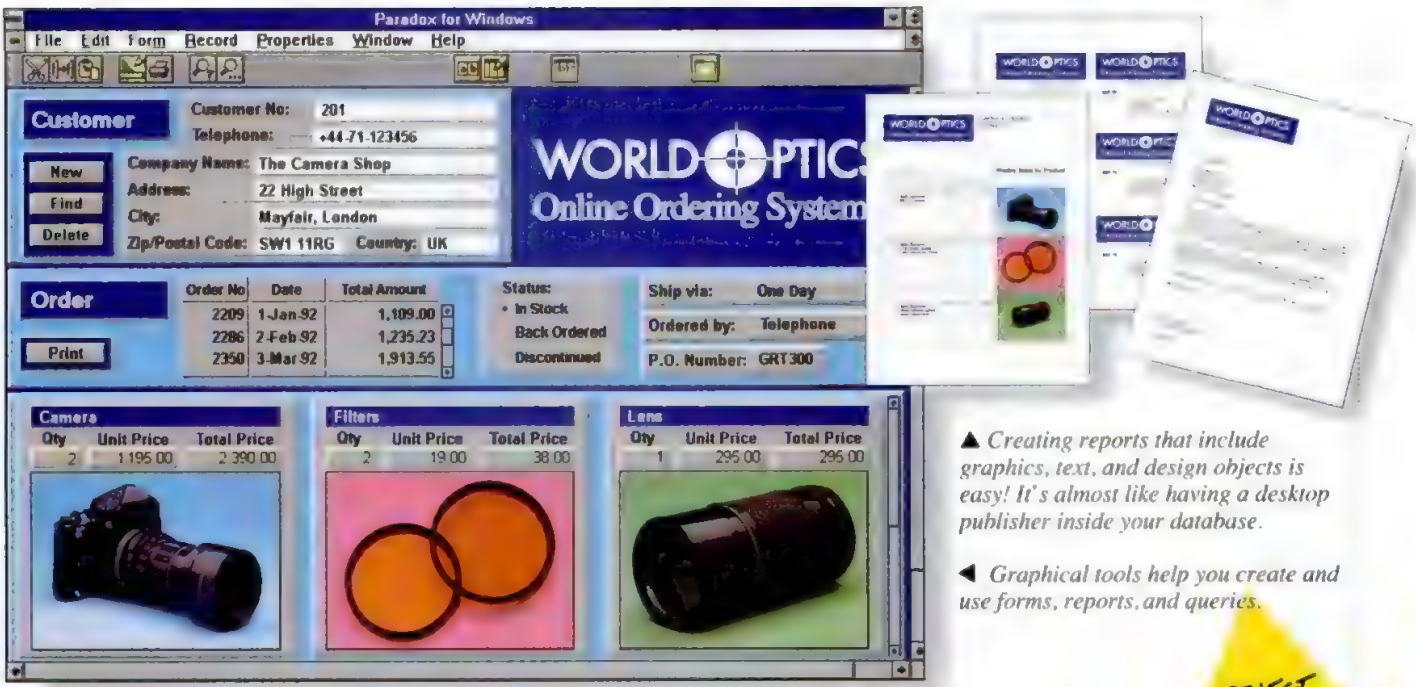
NO SLOT: *The backpack CD-ROM drive can be installed in just a few minutes.*

- Easiest to learn and use
- Relational database power
- Create graphical forms and reports with ease
- Instant answers to queries
- Effortlessly connect to your existing Paradox and dBASE data



Special Offer!

Paradox: the magic of database power made easy



▲ *Creating reports that include graphics, text, and design objects is easy! It's almost like having a desktop publisher inside your database.*

◀ *Graphical tools help you create and use forms, reports, and queries.*

Experience the magic of easy database power

If you're looking for the easiest-to-use, most powerful, and most reliable Windows database, this is it! With new Paradox® for Windows, there's no limit to what you can do. The graphical interface makes it easy to access, modify, and present your data. Create customer lists in seconds, automatically generate reports with the push of a button, or retrieve data from different sources with ease.

Paradox is the best Windows database

	Paradox	Access
Performance		
Insert 1,000 records*	29 sec	147 sec
Range selection: 15,000 of 130,000 records*	<1 sec	16 sec
Complete Paradox and dBASE file support	✔	
Visual data modeling for forms and reports	✔	
Object-oriented development environment	✔	

The best way to manage Paradox and dBASE data

Paradox for Windows makes it easy to work with your Paradox and dBASE® data. You can view, edit, query, and link to all your data, with no limitations. You make your request for data simply by checking off boxes with easy-to-use Query By Example. Then the Paradox for Windows query optimizer automatically determines the fastest way to deliver the answer.

Paradox for Windows lets you manage virtually unlimited data types. You can store any kind of information, including text, menus, graphics, OLE objects, sound, and even multimedia. You can even mix and match Paradox and dBASE data in queries, forms, and reports.

OBJECT COMPUTING NOW!

More people trust their PC data to Borland than all other database companies combined. That's why Borland is the Data Company. Put the power of Paradox to work for you today. You'll be amazed at what you can do.

Special introductory offer.
Offer expires April 30, 1993.

$139.95
(regular list price $795)

See your dealer or call now, 1-800-336-6464, ext. 5545

In Canada, call 1-800-461-3327.
90-day, money-back guarantee.

*All tests run on IBM® PS/2 Model 70 386/20 mhz, 4Mb RAM, Novell 3.11 NetWare, Ethernet network. Special offer good in the United States and Canada only. Prices in U.S. dollars.

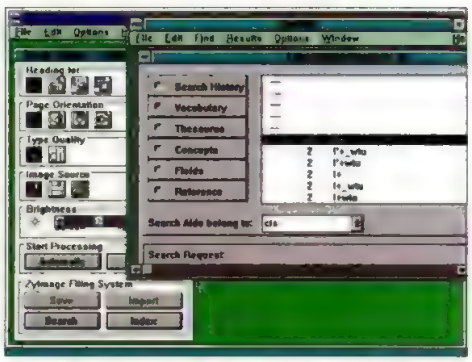
Copyright © 1993 Borland International, Inc. All rights reserved. All Borland product names are trademarks of Borland International, Inc. BI 4891

CIRCLE 220 ON READER SERVICE CARD

Windows Document Management

ZyImage: A Winning Combination of OCR And Text Indexing

BY BARRY SIMON



SEARCH: *ZyFindi does complex searches.*

ZyImage, Version 1.0, ZyLab and Calera Recognition Systems' joint entry into the burgeoning world of desktop document storage and retrieval combines optical character recognition and text indexing to turn your paper documents into searchable data. The program combines Calera's WordScan optical character recognition (OCR) software with a version of ZyLab's ZyIndex for Windows.

The ZyLab part of the package is $895, but you'll also need Calera's WordScan ($295) or WordScan Plus ($695).

ZyImage lets you collect documents in databases called index sets. The index consists of the path to the text files and pointers to every word in each document except for "noise words" like *the*.

The WordScan part of the combo is the current version, 1.1, but with an interesting wrinkle. When you run the Windows–based ZyScan, it starts WordScan and then hijacks its main dialog box to add four buttons labelled Save, Import, Search, and Index.

If you're adding paper documents to the database by scanning, you use WordScan as usual and then pick the Save button that ZyImage has added. This saves the document to disk, indexes the scanned document, and adds it to a chosen index set.

The other two buttons invoke two programs that can also be called directly from Program Manager: ZyBuild and ZyFindi. ZyBuild creates indices from text files already on disk in a variety of formats, including the ASCII format that your e-mail probably comes in, as well as the file formats of nine different word processors (AmiPro, DisplayWrite, Microsoft Word for DOS and Windows, MultiMate, Volkswriter, WordPerfect, WordStar, and XyWrite).

The first time you build an on-disk index, it can take some time. On our informal tests, a 386/25 took about 15 minutes to index each megabyte of input text. But after the initial indexing, the build which looks for new and changed files meeting the selection criteria is faster.

The crucial component is the powerful, flexible search engine in ZyFindi which lets you do Boolean searches, proximity searches, file- and date-restricted searches, and keyword searches as well.

Searching is lightning quick, and once you get a list of matching files, you can view the documents or launch the word processor to which the document is linked.

ZyImage is a great, high-end solution for any office or organization trying to create a heavy-duty document retrieval system.

• List price: *ZyImage, Version 1.0, $895.* Requires: *4MB RAM, 10MB hard disk space, Microsoft Windows 3.0 or later, Calera WordScan or WordScan Plus. ZyLab, 100 Lexington Dr., Buffalo Grove, IL 60089; 800-544-6339, 708-459-8000; fax, 708-459-8054.*

Circle 420 on reader service card

Windows Utilities

Sherlock Makes File Names Make Sense In Windows

BY HENRY FERSKO-WEISS

Have you ever found yourself scrolling madly through the File Open dialog box of a Windows application hunting for a file? Or trying to remember the "clever" eight-character name you gave a file? Physiotronics Corp. U.S.A.'s $179 Sherlock, Version 1.0, will soothe your frustrated nerves.

Sherlock stores your files with long descriptive names, keywords, and other informational fields. It also organizes your files into a visual structure of offices, cabinets, drawers and folders.

This utility isn't for everyone, however. If you use only one or two programs and you've already built a good system of subdirectories, then Sherlock won't do much for you. It doesn't work with database programs, and if you frequently use a DOS communications package, or exchange files with others, Sherlock will add annoying steps to your work because you have to export a Sherlock file to DOS to give it a name that non-Sherlock users might find meaningful.

Sherlock pops up a form when you select the Save As or Open commands or click the Save button in a Windows app. On the form, you enter a document description of up to 254 characters, and that serves as the document name. You can also enter a Document Type, Contact, User Name, Document Format, and Keyword (up to five per file). The more fields that you fill in, the more ways you have to search for a file later.

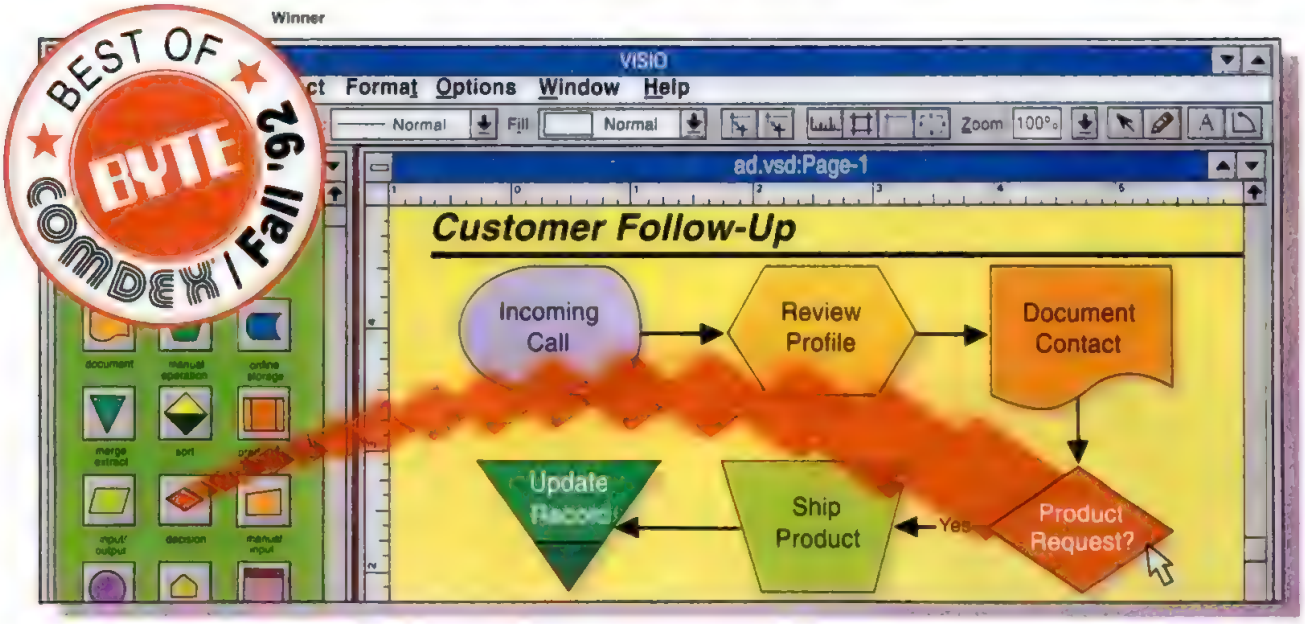
FILE SPECS: *Sherlock makes files easier to find.*

Sherlock-indexed files end up with DOS file names that are nothing more than a series of locator numbers. They're meaningless if you have to find a file in DOS, so Sherlock has an export feature that lets you send the file to DOS with a typical DOS name. Sherlock also has an automatic import feature that lets you tag a file or group of files and place them within the Sherlock structure. If you don't want to use Sherlock with every program, there is an Override button.

• List price: *Sherlock, Version 1.0, $179; five-user network version, $695.* Requires: *2MB RAM, 1.8MB hard disk space, Microsoft Windows 3.1. Physiotronics Corp. U.S.A., 135 W. 52nd St., 8th floor, New York, NY 10019; 800-952-2314, 212-887-9555; fax, 212-887-9546.*

Circle 417 on reader service card

VISIO IS FOR ANYONE WHO THINKS DRAWING IS A DRAG.



Now you don't have to be a graphic artist or draftsman to create impactful business and technical drawings. Because *if you can drag and drop, you can draw.* It's easy with Visio™, Shapeware's™ new drawing program for Microsoft® Windows™ 3.1 users.

By just clicking your mouse, Visio lets you drag and drop shapes, change their size or color, connect them automatically and type in text. Drag. Drop. Done! It's that easy.

Only Visio gives you more than 300 drag and drop SmartShapes™ to help you create virtually any drawing or diagram. Unlike clip art, SmartShapes are "intelligent." They can take on different forms, colors, and proportions and behave the way you expect. And with Visio's simplified tool set, you can easily create your own customized shapes using a single pencil tool.

For easy access, SmartShapes appear right on your screen on job-related "stencils." Each stencil features all the shapes you could possibly need for your specific drawing. There's a Visio stencil for flowcharts. One for space plans. Organizational charts. Business models. Marketing diagrams. Gantt charts. Computer network layouts. Engineering schematics. And direction maps. Visio includes 15 stencils, standard. And you can also get additional stencils for more specific jobs.

So if you need to concentrate on *what* you want to draw, not *how* to draw it, you need new Visio from Shapeware. The only Windows software that lets you draw from more than your imagination.

SPECIAL CHARTER OFFER.

Buy Visio now for just $249. And if you order and register by April 30, 1993, you'll also receive: ■ An additional Visio stencil set of your choice ■ A free issue of *Windows*, *Windows Sources*, **and** *Windows User* magazines ■ Free technical phone support for 90 days ■ A 60-day money-back guarantee. To order Visio, or for the names of authorized Visio resellers near you, call toll-free:

1-800-446-3335, ext. BD1

SHAPE WARE

CIRCLE 006 ON READER SERVICE CARD

Copyright Shapeware Corporation, 1992. Shapeware, Visio, Drag and Drop Drawing for Everyday Graphics and SmartShapes are trademarks of Shapeware Corporation. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.

DASHBOARD? I CAN'T GET ENOUGH OF THIS THING! I ZIP HERE, ZIP THERE... IT'S A BLAST! I'M EVEN STARTING TO WISH I HAD MORE WORK TO DO!

Computer users everywhere are thinking the unthinkable: Could Dashboard actually make working in Windows® faster and [gasp] more fun?

Well, Dashboard does have a truckload of convenient features, like extended virtual screens that let you create and save up to 9 different full-screen views, and switch between them instantly. And quick launch icons that launch your favorite applications with one click. Even a "fuel" gauge with warning lights to monitor memory, resources, and more.

So, is it fast? Let's just say that Dashboard is the fastest way to work in Windows. And leave the rest to your imagination.

1-800-554-1305 Ext. 601P

For more information or to order, call now!

*And just for fun, every 50th caller gets Dashboard FREE!**

FOR WINDOWS™ **Dashboard**

HEWLETT PACKARD

Fax inquiries 408 720-3560 © 1993 Hewlett-Packard. Dashboard is a trademark of Hewlett-Packard Company. Microsoft Windows is a registered trademark of Microsoft Corp.

*Offer ends June 30, 1993

CIRCLE 262 ON READER SERVICE CARD

New & Improved

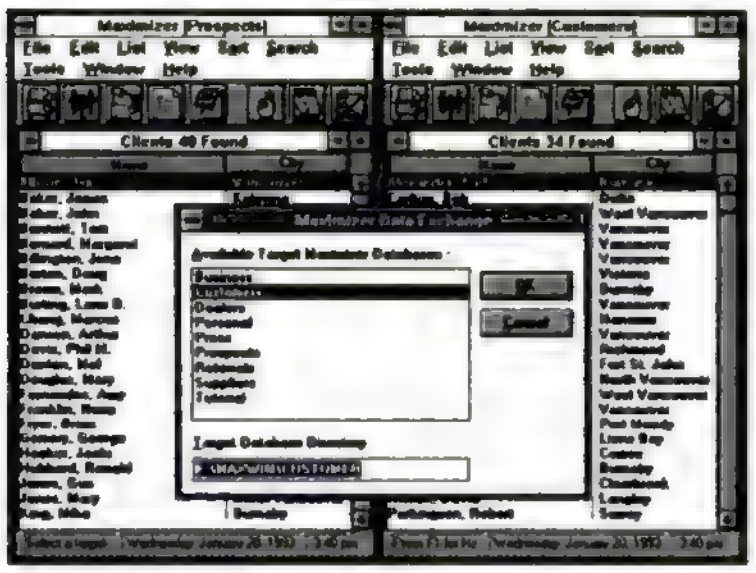
NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Brad Grimes

IMPROVED

Maximizer for Windows Is Now Network-Aware

Richmond Technologies & Software has revealed a network-aware version of its contact management software, Maximizer for Windows. Version 1.1 of the program will operate under LANtastic, VINES, Microsoft LAN Manager and Windows for Workgroups, and NetWare. It boasts several new features, including the ability to lock records at the item level, run multiple sessions of Maximizer, transfer data between databases, and schedule group meetings.



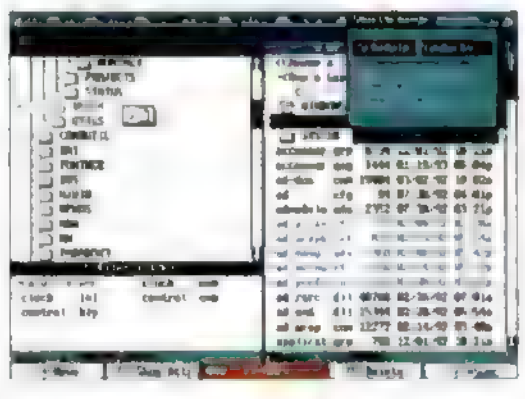
You can run multiple sessions of Maximizer and easily transfer data between databases.

The new record-locking feature means that when you work in a contact's record, another user can work on other items in the same record. Running multiple sessions of Maximizer lets you work with several databases simultaneously. Add to that the ability to transfer data between databases and you have the power to drag and drop contact records from one session directly to another on-screen. Maximizer 1.1's group scheduling feature can search calendars to find free time, and it can also schedule recurring meetings.

Now that Maximizer for Windows is network-aware, you no longer need a separate LAN version. Instead you can buy license packs from Richmond or its dealers.

•List price: *Maximizer for Windows, Version 1.1, $249; License Pack for concurrent user, $149. Richmond Technologies & Software Inc., 6400 Roberts St., #420, Burnaby, BC, Canada V5G 4C9; 604-299-2121; fax, 604-299-6743.*
Circle 402 on reader service card

HOT PROSPECT



LapLink V Makes File Transfers Easier Than Ever

Traveling Software has announced LapLink V, the next generation of its file transfer program. The new version includes usability enhancements such as moving arrows to show you in which direction files are being transferred, icons, a toolbar, and the ability to drag-and-drop. In addition, LapLink V now runs in the background, so the program can be minimized yet remain fully functional during a large transfer.

A new menu item, SmartXchange, is a collection of features for simplifying repetitive tasks. Scheduled Playback lets you transfer files at any time. An on-screen calendar lets you schedule long-distance transfers for times when phone rates are low, or schedule repetitive transfers, such as backups, at regular intervals. Synchronize makes the files in two directories identical and never overwrites newer files. Clone Directory makes a duplicate of a source directory on a target PC. And Refresh Directory updates a directory by copying only the files on the source PC that exist on the target and are newer.

LapLink V now transfers files peer-to-peer over NetWare 2.2 and 3.11 using IPX. You no longer have to waste space on the file server to transfer files like updated software programs.

•List price: *LapLink V, Version 5.0, $169.95. Traveling Software Inc., 18702 North Creek Pkwy., Bothell, WA 98011; 800-343-8080, 206-483-8088; fax, 206-487-1284.*
Circle 401 on reader service card

NEW

Dell Ships Three Ready-to-Run Multimedia Systems

Dell Computer Corp. is shipping a line of three integrated multimedia systems that are based on Dell's new 333s/L and 433s/L personal computers. The Dell KidStation (386SX/33), the StudentStation (386SX/33), and the OfficeStation (486SX/33) each come with 4MB of RAM, an 80MB to 170MB hard disk, a 3.5-inch floppy disk drive, a Super VGA monitor, a Creative Labs Sound Blaster or Sound Blaster Pro card, LabTec stereo speakers, DOS 5.0, and Windows 3.1. Each system can also be shipped with a $39 communications package that includes a 2,400-bps modem and the Prodigy Starter Kit.

The StudentStation and OfficeStation also include a LabTec microphone and a Panasonic CD-ROM drive. Software bundles vary based on the targeted user.

•List price: *Dell KidStation, $1,499; Dell StudentStation, $1,999; Dell OfficeStation, $2,499. Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-289-3355, 512-338-4400; fax, 800-727-8320.*
Circle 403 on reader service card

NEW

WinBEEP Software Lets You Send Messages to Beepers

Fourth Wave Technologies' new WinBEEP software can send messages to alphanumeric pagers from any PC running Windows 3.*x* and using a standard data modem. The pager alerts its carrier to the new message, which can be stored, prioritized, and then read at the earliest convenient time.

WinBEEP supports all standard paging protocols and can send messages from notebook PCs using cellular links. Built-in DDE support and a software development kit mean you can trigger WinBEEP to send messages from within applications at scheduled times, or in response to system events.

•List price: *WinBEEP, Version 1.0, $149. Fourth Wave Technologies Inc., 560 Kirts Blvd., #105, Troy, MI 48084; 313-362-2288; fax, 313-362-2295.*
Circle 404 on reader service card

NEW

WinPrinter 360XLS: Even Larger Output at 360 dpi

LaserMaster Corp. is now shipping its largest-output printer, the LaserMaster WinPrinter 360XLS. Using Canon's 17- by 22-inch bubble-jet engine, the 360XLS is capable of 360-dot-per-inch output in PostScript or LaserMaster's Windows direct driver modes. In addition to regular printing jobs on standard paper sizes, you can now take advantage of C-size (17- by 22-inch) real estate for printing large spreadsheets, presentation materials, or CAD drawings.

LaserMaster's FastPort technology transmits video data from the host computer to the print engine at speeds of up to 1.2MB per second, and, like all WinPrint models, the 360XLS has double-frame buffering for improved performance. LaserMaster rates the 360XLS at .25 pages per minute when printing to 17- by 22-inch paper. On the desktop, the unit occupies 5.5 by 23.7 by 13.9 inches and handles two optional paper trays that hold 125 sheets each.

•List price: *LaserMaster WinPrinter 360XLS, $1,795. LaserMaster Corp., 6900 Shady Oak Rd., Eden Prairie, MN 55344; 800-950-6868, 612-944-9330; fax, 612-944-0522.*

Circle 405 on reader service card

NEW

Super-TCP for Windows Uses New MIME Standard

The Multipurpose Internet Mail Extension (MIME) standard is meant to standardize the way different types of objects or parts within an e-mail message are delivered, and **Frontier Technologies Corp.** is shipping the first Windows-based TCP/IP e-mail program to include these extensions. Its product, Super-TCP for Windows, gives you the ability to send and receive PostScript images, spreadsheets, database files, word processor files, graphics files, and audio and video messages as part of SMTP (Simple Mail Transport Protocol) e-mail over TCP/IP networks.

Super-TCP for Windows features attachment notification to let you know if a message contains multiple MIME parts or attachments and a viewer for seeing text or graphics files directly in the e-mail program. Super-TCP for Windows supports NetWare, VINES, and LAN Manager.

•List price: *Super-TCP for Windows, $495. Frontier Technologies Corp., 10201 N. Port Washington Rd., Mequon, WI 53092; 414-241-4555; fax, 414-241-7084.*

Circle 406 on reader service card

BRIEFS

LOCAL BUS

Unisys Corp. has introduced its PW² Advantage Plus series of EISA-based personal computers featuring integrated ATI local-bus video controllers and built-in local bus Ethernet adapters. Each system is equipped with an OverDrive socket that will accept Intel's Pentium chip. The Advantage Plus 4333 ($3,599) has a 33-MHz 486 processor and a 240MB hard disk. Model 4666 ($4,499) uses a 66-MHz 486DX2 and sports a 340MB hard disk. The 4668, a standing file server, comes with a 66-MHz 486DX2 processor and a 525MB hard disk. 800-448-1424.

Polywell Computers is shipping the Poly 486/66EV ($2,700), an EISA-based system featuring VESA-compliant local-bus video and a VESA IDE disk controller with 2MB of disk cache. It ships with an Intel 66-MHz 486DX2 processor, 8MB of RAM, a 213MB hard disk, and an S3 805 video accelerator card. An advanced model, the Poly 486/66EW ($3,950) comes with 16MB of RAM, a 520MB SCSI-2 hard disk, a VESA 32-bit Bus Master SCSI-2 controller, and a Weitek 9000 SuperFast video card. 415-583-7222.

Memorex Telex has rolled out the Memorex Telex 8000 Local Bus family of ISA-based PCs running on Intel 33-MHz 486SX, 33-MHz 486DX, and 66-MHz 486DX2 processors. The 8080-33L ($2,336), 8090-33L ($2,636), and 8092-66L ($3,106) all feature two VESA-compliant local-bus slots, one of which holds a Super VGA video controller. The other can hold an optional VL-Bus SCSI adapter (base systems come with an integrated IDE local bus drive interface). Configurations also include 4MB of RAM, a 170MB hard disk, and a Super VGA monitor. 800-944-4455, 214-444-3500; fax, 214-444-3501.

SOFTWARE

Atech Software is shipping DataSel Gold ($79), a contact management program with a card file, notepad, and appointment calendar. Unlimited notes can accompany each contact, and contacts can be searched by using 16 different fields. 800-786-3668, 619-438-6883.

NEW

Intel Continues to Launch Network Products

Intel Corp. is broadening its line of networking products with new hardware and software, and introducing technology to make network management easier. The EtherExpress FlashC LAN Adapter is an 8/16-bit ISA card incorporating 256K of flash memory for storing hardware component information and Intel FlashWorks utilities for managing all such adapters over a LAN from a central location. The EtherExpress 16C LAN Adapter is an 8/16-bit ISA card that functions as Intel's Softset utility for automatic configuration and a socket that accepts 256K of flash memory or boots ROMs for NetWare and Microsoft LAN Manager.

Intel has also begun shipping its LANDesk Manager, a set of tools for managing networked desktop systems and related local network services. Information stored in the EtherExpress FlashC's memory can be read across the network, and the LANDesk Manager can be used to troubleshoot a workstation or a file server. The software uses a single Windows-based interface and supports NetWare 3.1 LANs.

•List price: *EtherExpress FlashC LAN Adapter, $199; EtherExpress 16C LAN Adapter, $189; LANDesk Manager, $995. Intel Corp., 5200 NE Elam Young Pkwy., Hillsboro, OR 97124; 800-538-3373, 503-629-7354; fax, 800-525-3019, 503-629-7576.*

Circle 408 on reader service card

NEW

MIDIScan for Windows Turns Sheet Music into MIDI Files

Musitek has announced MIDIScan for Windows, a music-reading software package that automatically converts printed sheet music into multitrack MIDI files. The process is similar to optical character recognition (OCR): A scanner captures an image of the score, then the music reading software (MRS) extracts the notes and displays them as standard notation in an interactive window for easy point-and-click editing.

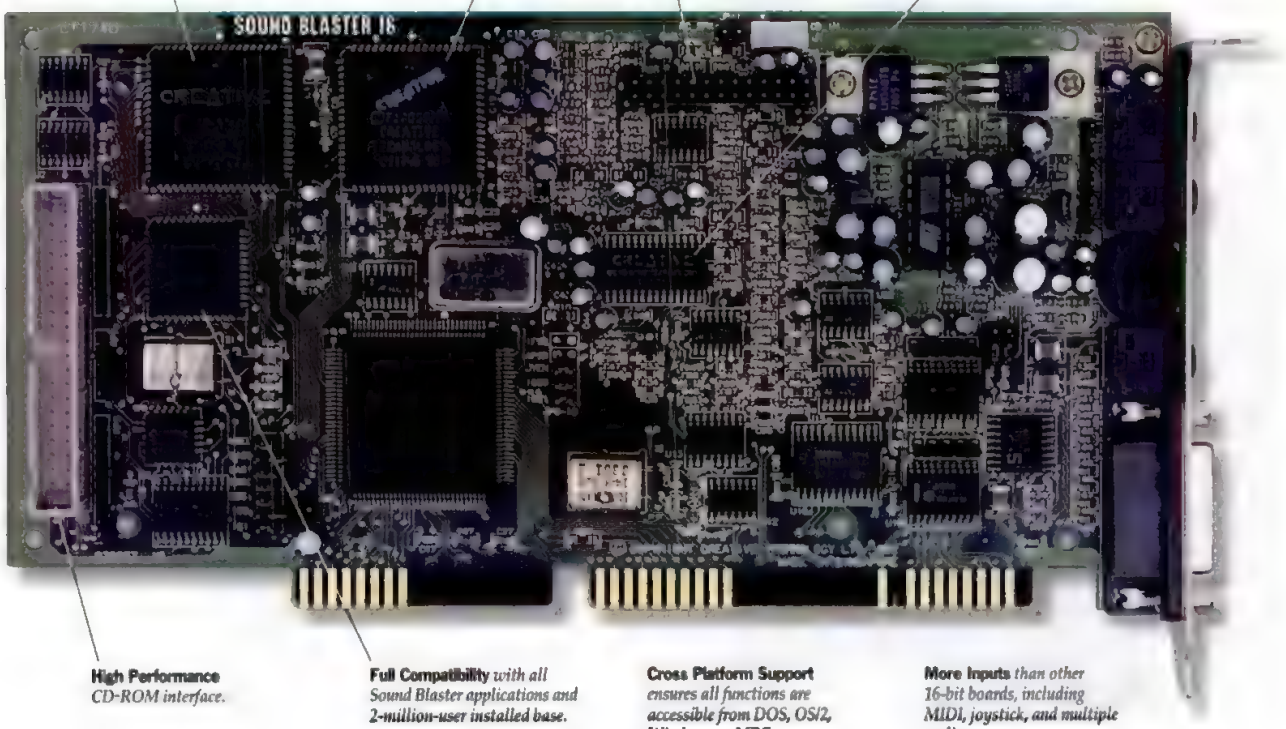
MIDIScan recognizes note pitches, note and rest durations, chords, accidentals, bar lines, clefs, and key and time signatures with up to 98 percent accuracy. The program processes multiple pages of a musical score and corrects skewed images while ignoring non-note objects such as titles, lyrics, and other markings. The

Advanced Signal Processing *(ASP) delivers 4:1 realtime hardware data compression and saves up to 65% of CPU processing time.*

Enhanced Features *include programmable mixing, multiple-source recording, treble and bass controls.*

Wave Blaster™ upgrade option *for next generation wave table music synthesis.*

State-of-the-Art *16-bit Codec with 90 dB signal-to-noise ratio.*



High Performance *CD-ROM interface.*

Full Compatibility *with all Sound Blaster applications and 2-million-user installed base.*

Cross Platform Support *ensures all functions are accessible from DOS, OS/2, Windows or MPC.*

More Inputs *than other 16-bit boards, including MIDI, joystick, and multiple audio sources.*

Sound Blaster 16 ASP. We're not playing games anymore.

Sure, games are great. But with new applications ranging from voice recognition to full-blown integrated multimedia, it's time to get serious about PC audio. With Sound Blaster™ 16 ASP.™

The 16 ASP comes with all the features you'd expect on a professional-quality sound board, plus more than $500 in bundled software…all for a suggested retail of just under $350.

But the real secret lies in Creative Labs' exclusive Advanced Signal Processing technology: realtime hardware data compression that delivers full CD-quality stereo at a fraction of the CPU power required by other 16-bit boards. And downloadable algorithms that enable future upgrades like voice recognition, time control and special effects.

So if you thought the original Sound Blaster set the standard for games, you're right. But the 16-bit PC Sound Barrier has now been broken. With Sound Blaster 16 ASP: the new Sound Standard for CD-quality PC Audio.

For more information call 1-800-998-LABS.

Sound BLASTER

CREATIVE
CREATIVE LABS, INC.

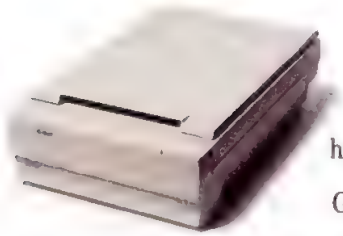
© Copyright 1992 Creative Labs, Inc. All specifications subject to change without notice.
Sound Blaster, ASP, and Wave Blaster are trademarks of Creative Labs, Inc. All other software and trademarks are owned by their respective companies.
International inquiries: Creative Technology Ltd. Singapore, TEL 65-733-0233. FAX 65-773-0353.

CIRCLE 086 ON READER SERVICE CARD

There's a reason they're called "bullet points".

- you practically have to put
- a gun to someone's head
- to make him read them

All company and or product names are trademarks and or registered trademarks of their respective manufacturers. Epson is a registered trademark of Seiko Epson Corp.
©1995 Epson America,Inc., 20770 Madrona Ave., Torrance, CA 90509. For dealer referral, call **800-BUY-EPSON**(800-289-3776). In Canada, call(800)GO-EPSON. For Latin America, 305-265-0092.



If you want to blow away clients the next time you have a presentation, try this.

Grab a photo — something eye-catching, but tasteful. Toss it onto one of our Epson® Color Scanners. Transport it into your text. Print and present. It works every single time. Clients actually follow along *voluntarily*.

That's because images grab people's attention. And once you grab that, then you can grab their ears and minds.

Even more importantly, when you choose an Epson color scanner, you're not just buying a box. You're also getting a full version of Micrografx® Picture Publisher® 3.1 — only the hottest software around. The Caere® OmniPage® Direct OCR TryPack, so you can scan in text. And whether you opt for our 600C or 800C scanner, you always get 24-bit single pass color scanning with almost 17 million colors.

Before.

After.

To learn more about scanners, call 1-800-289-3776 and ask for representative 83. We'll send you our free booklet.

Then, just in case you really want to go all out, we've designed lots of handy add-ons, like auto-document feeders and transparency units. And, as always, we offer a one year warranty. It's kind of silly given the way we make things around here, but we do it anyway just so you know we're there if you need us.

So go ahead. Make your client's day. Check out one of our color scanners.

EPSON®

MIDIScan takes notes from a scanned score (top) and puts them in a format for editing (bottom).

software recognizes sheet music at a rate of about 5 minutes per page.

•List price: *MIDIScan for Windows, Version 1.0, $379, Musitek, 410 Bryant Circle, Suite K, Ojai, CA 93023; 805-646-8051; fax, 805-646-8099.*

Circle 407 on reader service card

IMPROVED

Competition Heats Up in Remote-Control Arena

Two remote-control software products, **Triton Technologies'** CO/Session and **Ocean Isle Software's** ReachOut, have recently undergone improvements. CO/Session, Version 6.1, is now able to load itself into upper memory automatically. It also now provides Super VGA support under Windows. Triton has further improved the Windows performance of CO/Session by creating virtual communication port and communication buffer drivers for Enhanced mode operations. Furthermore, it includes command line file transfers and support for 16550 UART FIFO serial ports.

Ocean Isle has built more features into Version 3.2 of ReachOut. A short time ago, Version 3.1 saw the incorporation of a three-tiered security system. The newest version has a virus scanner for detecting viruses during file transfers and an enhanced terminal emulator. ReachOut 3.2 supports ANSI, VT-100, VT-52, and TTY terminal emulation and X-modem, Y-modem, Z-modem, Kermit, and ASCII file transfer protocols.

•List price: *CO/Session, Version 6.1, $179. Triton Technologies Inc., 200 Middlesex Tpke., Iselin, NJ 08830; 800-322-9440, 908-855-9440; fax, 908-855-9608. ReachOut, Version 3.2, $179. Ocean Isle Software, 49 Royal Palm Blvd., Vero Beach, FL 32960; 800-677-6232, 407-770-4777; fax, 407-770-4779.*

Circle 409 on reader service card

BRIEFS

SOFTWARE

Fraction Fonts ($25), from **White Dog Communication Services,** gives Windows users the ability to put fractions in their applications easily, using Type 1 and TrueType formats. A partial set can be downloaded from a variety of forums on CompuServe, including ZiffNet, for $10. 515-993-3115.

Timeworks is offering Data Manager for Windows ($199.95), a graphical database with a query language and report generator, as well as support for relational file linking, DDE, and storage of graphics. It comes bundled with SoftKey's Key Form Designer for Windows. 708-559-1300; fax, 708-559-1399.

Firesign Computer Company has enhanced the speed of unattended file transfers for Version 3.0 of Outbound ($150). This is accomplished by changing its communications protocol and using a dictionary-based compression scheme. 800-825-7228.

Emerald Systems' Windows-based backup and storage management program, Xpress Librarian, Version 2.0 ($995), now supports Microsoft Windows for Workgroups across Novell networks. Administrators can now back up every workstation running Windows for Workgroups along with all file servers. 619-673-2161; fax, 619-673-2288.

Ventura Software is now shipping Publisher's PowerPak ($995), which includes Ventura Publisher 4.1 for Windows, Ventura DataBase Publisher 4.0 for Windows, Ventura AdPro 1.1 for Windows, and Ventura PicturePro 1.1 for Windows. 619-673-0172.

PC-Kwik Corp. announced Version 1.5 of its WinMaster utility kit ($129.95) with enhancements to the Toolbox, KwikInfo, Power Disk, and KwikVault modules. Included in the new Toolbox is KwikFind, a tool that searches multiple volumes for text and then allows you to view, launch, or delete the files you find. WinMaster now comes bundled with Super PC-Kwik disk cache and PC-Kwik RAM Disk. 800-759-5945, 503-644-5644.

NEW

Build A Terminal: New Model Has Two PCMCIA Slots

Link Technologies has gone one-up on terminal vendors that put PCMCIA-standard flash memory on their network cards. The new MAX/it (Modular, Adaptable, Expandable, Intelligent Terminal) line of alphanumeric terminals comes with two PCMCIA Type II-compatible card slots on the back of the display. This Options/OPEN feature means video RAM or font RAM can reside on a flash memory card that is placed in one of the slots, while the other slot can utilize industry-standard PCMCIA options such as modem or network cards.

The MAX/it can accept cards for all leading emulations, including ASCII/ANSI/PCTerm, IBM, Burroughs Poll Select, Sperry Uniscope, and DEC VT. It can also connect to networks running NetWare or TCP/IP. Along with two PCMCIA slots, the back plane has an I/O panel that can accommodate three serial ports, a parallel port, and an Ethernet port. The MAX/it has been designed for easy customization, right down to its single-screw construction.

Two Type II PCMCIA slots make Link Technologies' new MAX/it terminals easy to customize and upgrade.

•List price: *Link Technolgies Inc., 46595 Landing Pkwy., Fremont, CA 94538; 800-448-5465, 510-651-8000; fax, 510-651-8808.*

Circle 410 on reader service card

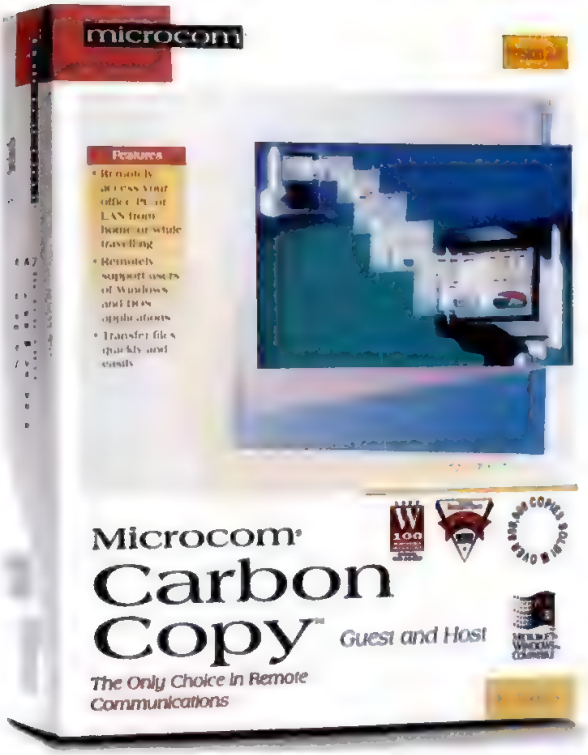
NEW

Powercore Brings WinMail to American Market

WinMail was previously available only in Europe, but now that Powercore and Finansa Ltd. have merged to form **Powercore International,** a new version of the e-mail product, WinMail 1.5, is now on sale in the U.S. The product incorporates a DOS client that is fully key- and mouse-compatible with the Windows client. It was designed as a DLL (dynamic link library) to avoiding tying you to a

Photography by Thom O'Connor

Carbon Copy.



New Windows Version

Best Value

- **NEW!** Now supports Windows ***and*** DOS in one box
- **NEW!** LAN and Modem support in one box

Best Performance

- **NEW!** Fastest file transfer and remote screen updates

Easiest To Use

- Still the only true Windows graphical interface

The Only Choice.

When You Can't Always Be At The Office.

Use Carbon Copy to access your office PC and LAN from home or on the road.

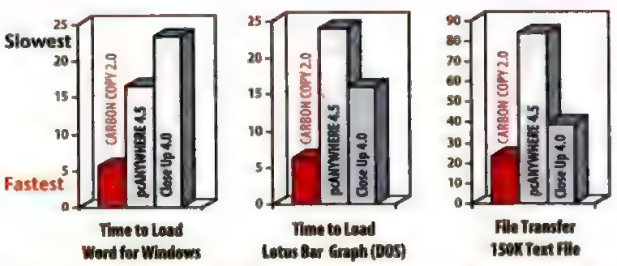
- Send and retrieve files
- Check your e-mail
- Use applications on your office PC remotely

When Your Customers Need You To Be There.

Use Carbon Copy to support your customers over modems or LANs.

- Support both Windows and DOS users
- Troubleshoot and train without leaving your desk
- Distribute software upgrades

Carbon Copy. The Only Choice in Remote Communications.



Performance measured in seconds using 9600 bps modems, 386/25 Host and 486/25 Guest.

". . . the closest thing to having remote control built into Windows itself." - Windows Magazine

Visit your local dealer or call Microcom for the dealer nearest you. And find out why Carbon Copy is the only choice for over 800,000 users.

800-822-8224

microcom®

Microcom, Inc. 500 River Ridge Drive, Norwood, MA 02062-5028
(617) 551-1000; Fax: (617)551-1021; International Fax: (617) 551-1007

$49 Upgrade! Now for a limited time, upgrade from any remote control software, including any version of Carbon Copy, to Carbon Copy for Windows 2.0 for only $49. Call 1-800-765-1750 today.

Microcom's other PC connectivity products include: MicroPorte and QX high speed portable and desktop modems; Microcom Bridge/Router remote internetworking and LANlord desktop management software.

© Microcom, Inc. 1993. Microcom and LANlord are registered trademarks and Carbon Copy, MicroPorte, Microcom Bridge/Router, and QX are trademarks of Microcom Systems, Inc.

CIRCLE 107 ON READER SERVICE CARD

suite of applications, and it integrates its mail services into the menus of most Windows software.

WinMail 1.5 includes a fax viewer for displaying attachments within the e-mail program and supports sending multiple attachments across MHS gateways. It also features rules-based message filtering that allows you to automatically filter incoming mail and file it away in customized folders for future reading. The rules technology is driven by dialog boxes rather than a scripting language, to make filtering easier.
•List price: *WinMail, Version 1.5, five users, $495. Powercore International Inc., One Diversatech Dr., Manteno, IL 60950-0756; 800-237-4754 ext. 109, 815-468-3737; fax, 815-468-3867.*
Circle 413 on reader service card

NEW

Fujitsu's Pen System: 3-volt Processor and PCMCIA Slots

The new Fujitsu 325Point pen-based system from **Fujitsu Personal Systems** weighs 3 pounds and runs on a 3-volt AM386SXLV processor operating at 25 MHz. It comes with 4MB of RAM, two PCMCIA slots, a choice of solid-state disk or 1.8-inch hard disk card, and a ROM card that contains DOS 5.0, Microsoft Mouse emulation, and 2MB of flash memory.

The 1.2- by 11.7- by 8.7-inch (HWD) 325Point comes with a 9.4-inch LCD that offers backlighting on demand, 640-by-480 resolution, and 64 gray scales. The battery life is rated between 3 to 8 hours depending on usage and on whether you use the standard nickel cadmium battery or choose the optional nickel hydride. The system will support multiple pen-operating systems, including Microsoft Windows for Pen Computing, PenDos, and PenPoint, plus a variety of pen development environments such as Slate Corp.'s PenApps, GRiD Systems' PenRight!, and PenPal Associates' Power PenPal.
•List price: *Fujitsu 325Point, $2,995. Fujitsu Personal Systems Inc., 5200 Patrick Henry Dr., Santa Clara, CA 95054; 800-831-3183, 408-982-9500; fax, 408-496-0575.*
Circle 412 on reader service card

IMPROVED

Full Text of InfoWorld Added to Computer Select CD-ROM

Ziff Desktop Information's Computer Library group now includes the full text of InfoWorld in its Computer Select database of product and industry information. The addition brings the number of full-text publications in Computer Select to 71.

Computer Select, which is available on CD-ROM as an annual subscription and on-line through ZiffNet, also features the new ZDScan user interface. Using Dataware Technologies' CD Answer retrieval engine, ZDScan expands the search, print, and help capabilities of Computer Select. ZDI is a division of Ziff Communications Co., publisher of *PC Magazine.*
•List price: *Computer Select, 12-month subscription, $995. Computer Library, One Park Ave., New York, NY 10016; 800-827-7889, ext. 517, 212-503-4400; fax, 212-503-4414.*
Circle 411 on reader service card

BRIEFS

STORAGE DEVICES

Ricoh Corp. is entering the PC market with four external and internal rewritable optical drives. The HyperSpace PC/e ($4,195) and HyperSpace PC/i ($4,095) are 5.25-inch, 650MB drives, while the Transporter PC/e ($2,195) and Transporter PC/i ($1,995) are 3.5-inch, 128MB drives. All of the devices come equipped with CorelSCSI driver software and utilities. 800-955-3453, 408-432-8800.

Pinnacle Micro has introduced a new 3.5-inch rewritable optical drive with an access time of 19 milliseconds, called the PMO-130 ($1,895). The PS/2 system is offered for $1,995. The drive comes in external or internal versions and provides 128MB of storage capacity per disk. The split optic design reduces the weight of the optic head and the data queuing on read/writes allows greater throughput. 800-553-7070, 714-727-3300; fax, 714-727-1913.

Storage Dimensions is shipping a Fast SCSI-2 storage subsystem based on a 5.25-inch form factor 2.8GB disk drive called LANStor 2FAST. Designed for use with NetWare 3.11 and 4.0, configurations include single-, dual-, and four-drive subsystems to deliver 2.85GB to 11.4GB of storage ($11,090 to $41,610). 408-954-0710; fax, 408-944-1200.

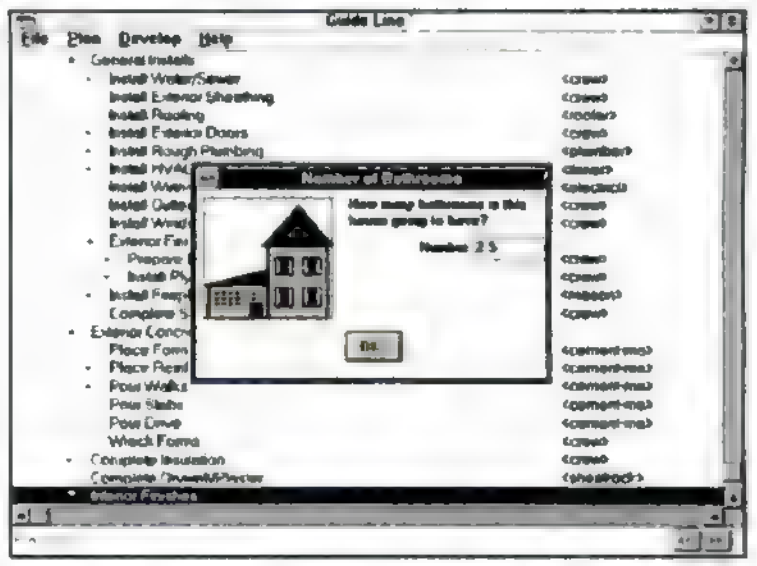
SyDOS, a division of SyQuest Technology, has introduced the SyDOS 88 *extra* in internal ($999) and external ($1,069) configurations. SyDOS 88 extra is a removable-cartridge, 88MB disk drive sub system that now reads and writes to either 44MB or 88MB cartridges. 407-998-5400, 407-998-5414.

Toshiba's Disk Products Division has added the MK-2326F series to its family of 2.5-inch Winchester disk drives. The MK-2326FC ($625) has a PC-AT interface and features 340MB of storage space and a 12-millisecond average seek time. A related product, the MK-2326FB, is slated for shipment in the future; it will offer a SCSI interface. 714-583-3000.

IMPROVED

Symantec Turns ProjectGuide Into Guide Line

Symantec Corp. has taken Marin Research's ProjectGuide (First Looks, October 13, 1992), tweaked the interface, and turned it into Guide Line, Version 1.0, a project scheduling program that makes creating project schedules as easy as answering a series of questions. When you respond to project-related questions, Guide Line determines tasks, timing, dependencies, and resources and then automatically generates a Time Line 5.0, Time Line for Windows, or On Target for Windows schedule. It is available in DOS and Windows versions.

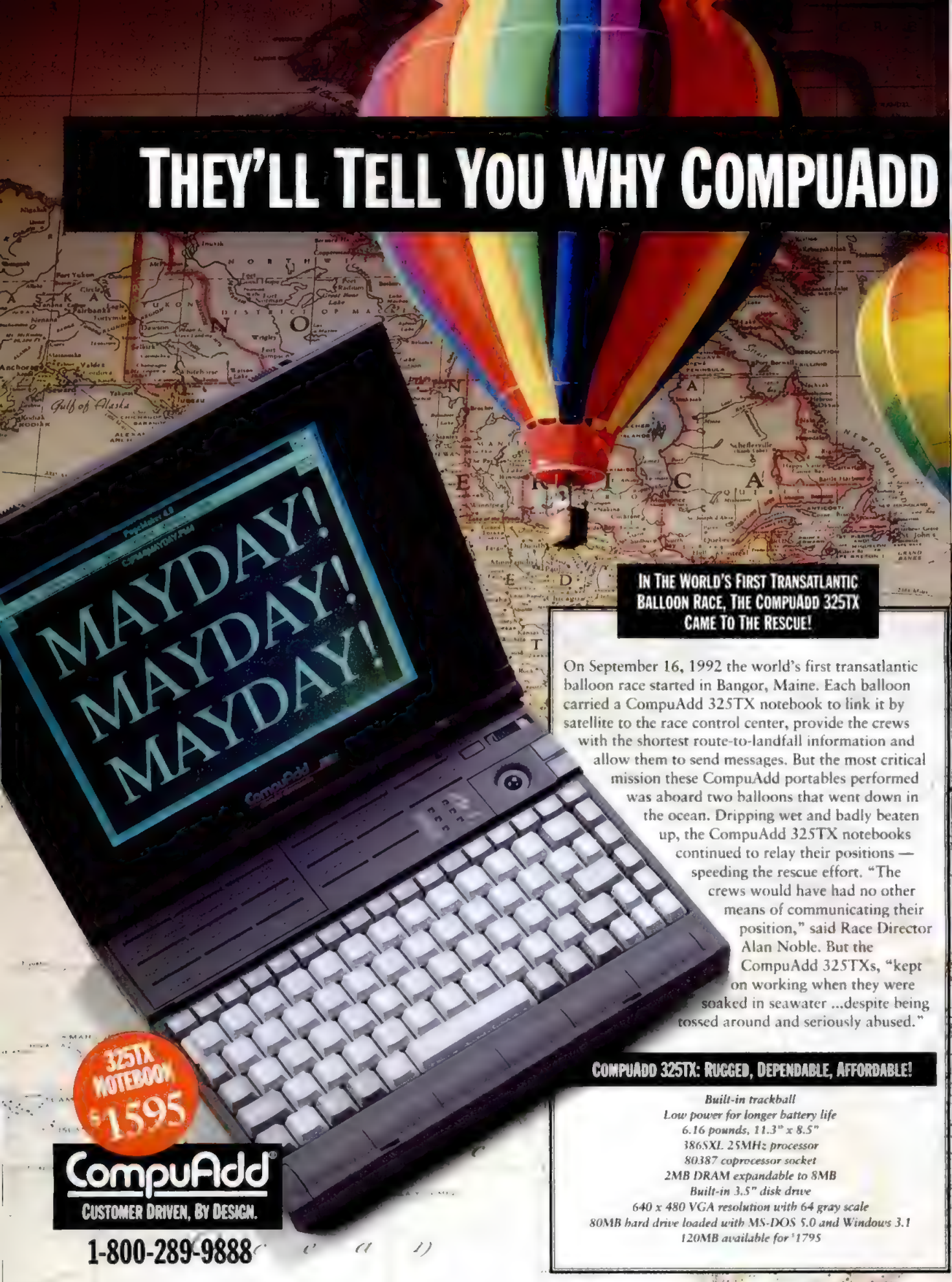


Guide Line creates project schedules by asking a series of questions.

Also available is Guide Line Maker, an authoring system that lets you build project management guides from scratch or previously created schedules. If you want to use Guide Line to create schedules for Microsoft Project for Windows, you can buy the Guide Line License Pack.
•List price: *Guide Line, Version 1.0, $149.95; Guide Line Maker, $499; Guide Line License Pack, $299. Symantec Corp. 10201 Torre Ave., Cupertino, CA 95014-2132; 800-441-7234, 408-252-3570; fax, 408-253-4694.*
Circle 414 on reader service card

IF YOU WANT TO KNOW
ABOUT PORTABLES,
ASK THE WORLD'S
LIGHTWEIGHT EXPERTS

THEY'LL TELL YOU WHY COMPUADD



IN THE WORLD'S FIRST TRANSATLANTIC BALLOON RACE, THE COMPUADD 325TX CAME TO THE RESCUE!

On September 16, 1992 the world's first transatlantic balloon race started in Bangor, Maine. Each balloon carried a CompuAdd 325TX notebook to link it by satellite to the race control center, provide the crews with the shortest route-to-landfall information and allow them to send messages. But the most critical mission these CompuAdd portables performed was aboard two balloons that went down in the ocean. Dripping wet and badly beaten up, the CompuAdd 325TX notebooks continued to relay their positions — speeding the rescue effort. "The crews would have had no other means of communicating their position," said Race Director Alan Noble. But the CompuAdd 325TXs, "kept on working when they were soaked in seawater ...despite being tossed around and seriously abused."

325TX NOTEBOOK $1595

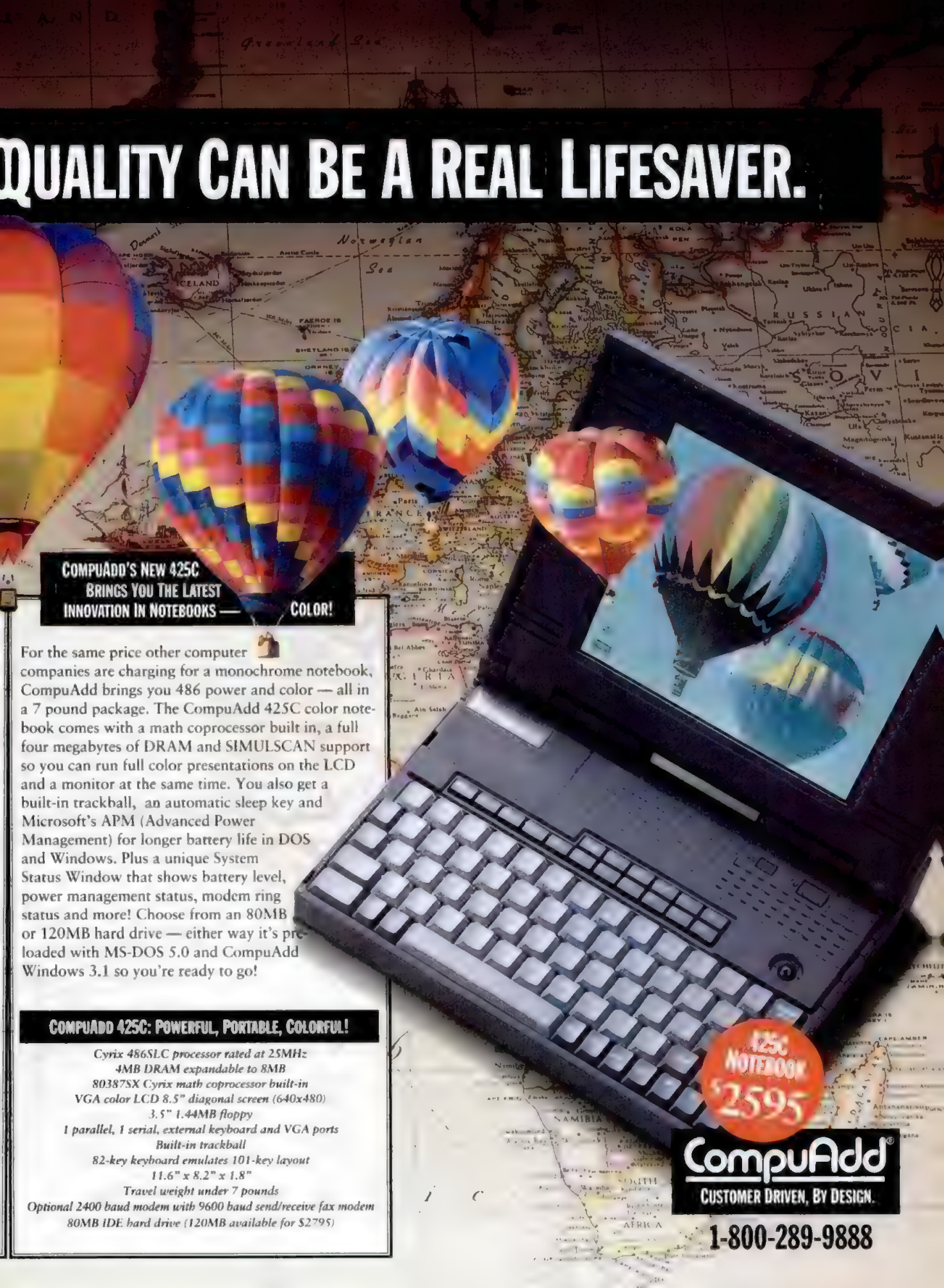
CompuAdd®
CUSTOMER DRIVEN, BY DESIGN.

1-800-289-9888

COMPUADD 325TX: RUGGED, DEPENDABLE, AFFORDABLE!

Built-in trackball
Low power for longer battery life
6.16 pounds, 11.3" x 8.5"
386SXL 25MHz processor
80387 coprocessor socket
2MB DRAM expandable to 8MB
Built-in 3.5" disk drive
640 x 480 VGA resolution with 64 gray scale
80MB hard drive loaded with MS-DOS 5.0 and Windows 3.1
120MB available for $1795

QUALITY CAN BE A REAL LIFESAVER.



COMPUADD'S NEW 425C BRINGS YOU THE LATEST INNOVATION IN NOTEBOOKS — COLOR!

For the same price other computer companies are charging for a monochrome notebook, CompuAdd brings you 486 power and color — all in a 7 pound package. The CompuAdd 425C color notebook comes with a math coprocessor built in, a full four megabytes of DRAM and SIMULSCAN support so you can run full color presentations on the LCD and a monitor at the same time. You also get a built-in trackball, an automatic sleep key and Microsoft's APM (Advanced Power Management) for longer battery life in DOS and Windows. Plus a unique System Status Window that shows battery level, power management status, modem ring status and more! Choose from an 80MB or 120MB hard drive — either way it's pre-loaded with MS-DOS 5.0 and CompuAdd Windows 3.1 so you're ready to go!

COMPUADD 425C: POWERFUL, PORTABLE, COLORFUL!

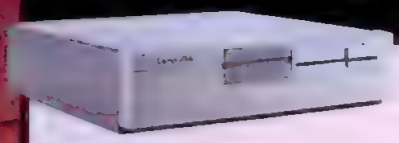
Cyrix 486SLC processor rated at 25MHz
4MB DRAM expandable to 8MB
80387SX Cyrix math coprocessor built-in
VGA color LCD 8.5" diagonal screen (640x480)
3.5" 1.44MB floppy
1 parallel, 1 serial, external keyboard and VGA ports
Built-in trackball
82-key keyboard emulates 101-key layout
11.6" x 8.2" x 1.8"
Travel weight under 7 pounds
Optional 2400 baud modem with 9600 baud send/receive fax modem
80MB IDE hard drive (120MB available for $2795)

425C NOTEBOOK $2595

CompuAdd®
CUSTOMER DRIVEN, BY DESIGN.

1-800-289-9888

COMPARED TO OUR HIGH-FLYING MACHINES, THE COMPETITION NEVER GETS OFF THE GROUND.



LOW-PROFILE SERIES
COMPUADD 433

i486DX microprocessor rated at 33MHz
4MB RAM expandable to 32MB
170MB hard drive
8KB on-chip cache, 128 external cache memory
Base price includes 14" CVGA monitor
Supports up to 1024x768 non-interlaced CVGA monitor
5.25" (1.2MB) and 3.5" (1.44MB) dual integrated floppy diskette drive
One parallel and two serial interfaces
Two 8-bit half-length and three 16-bit full-length expansion slots
Measures 16.5" x 15.5" x 4.2"
Comes preloaded with MS-DOS 5.0, Windows 3.1 and Novell NetWare® Lite™ 1.1W
Includes CompuServe starter kit

$1895

**Other microprocessor options in this chassis: Cyrix 486SLC rated at 25MHz, i486SX rated at 25MHz, i486DX2 rated at 50MHz internal/25MHz external*

DESKTOP POWER SERIES
COMPUADD 450DX2

i486DX2 microprocessor rated at 50MHz internal, 25MHz external
80MB hard drive
4MB RAM expandable to 64MB
8KB on-chip cache, 64KB external cache memory (256KB option)
Base price includes 14" CVGA monitor
Supports up to 1024x768 non-interlaced CVGA monitor
Enhanced Windows accelerator with 1MB video RAM, supports 72Hz
Intel OverDrive™ socket for optional OverDrive chip
5.25" (1.2MB) and 3.5" (1.44MB) dual integrated floppy diskette drive
One parallel and two serial interfaces
Three internal and three external drive bays
Measures 16.9" x 16.7" x 6.2"
Comes preloaded with MS-DOS 5.0, Windows 3.1 and Novell NetWare® Lite™ 1.1W
Includes CompuServe starter kit

$2465

**Other microprocessor options in this chassis: Cyrix 486DLC rated at 33MHz, i486DX rated at 33MHz, i486SX rated at 33MHz, i486DX2 rated at 66MHz internal/33MHz external*

TOWER SYSTEMS
COMPUADD 433E

i486DX microprocessor rated at 33MHz
4MB DRAM expandable to 256MB
80MB hard drive
8KB on-chip cache, 64KB external cache memory (256KB option)
32-bit EISA-based bus architecture
Includes Intel OverDrive™ socket for optional OverDrive chip
Base price includes 14" CVGA monitor
Supports up to 1024x768 non-interlaced CVGA monitor
Enhanced Windows accelerator with 1MB video RAM, supports 72Hz
5.25" (1.2MB) and 3.5" (1.44MB) dual integrated floppy diskette drive
5 internal and 4 external half-height drive bays
8 expansion slots
Measures 8" x 19" x 26.2"
Comes preloaded with MS-DOS 5.0, Windows 3.1 and Novell NetWare® Lite™ 1.1W
Includes CompuServe starter kit

$2595

**Other microprocessor options in this chassis: Cyrix 486DLC rated at 33MHz, i486DX rated at 33MHz, i486SX rated at 33MHz, i486DX2 rated at 50MHz internal/25MHz external, i486DX2 rated at 66MHz internal/33MHz external*

intel inside

The Intel Inside Logo is a trademark of Intel Corporation

ONLY 3 FROM OUR HUGE FLEET OF SYSTEMS! CALL FOR MORE INFORMATION ON OUR COMPLETE PRODUCT LINE!

THE EXTRAS THAT MAKE A COMPUADD SYSTEM SUCH A GREAT DEAL:

Each system custom-configured to your order and tested
24-hour toll-free tech support 7 days a week
30-day money-back guarantee
Flexible warranty packages and on-site service
Helpline for first-time buyers (800-999-8791)

TO ORDER OR FOR A COMPUADD CORPORATE CATALOG, CALL 800-627-1967

To order from outside the US, call 001-512-258-5575 or fax 001-512-250-2060;
Or call toll-free: from Australia 0014-800-124-020, Canada 800-627-1967, Guam 001-1-800-671-0172, Japan 0031-12-3396, Mexico 95-800-627-1967.

COMPUADD IS YOUR COMPUTING TECHNOLOGY RESOURCE FOR EVERYTHING FROM COLOR NOTEBOOKS TO TOWER CONFIGURATIONS—INCLUDING THE LATEST IN RISC SYSTEMS, NETWORK CONSULTATIONS/SET-UP, AND A RANGE OF PERIPHERALS AND SOFTWARE.

For a hands-on retail experience visit any of our 100+ CompuAdd Superstores nationwide!
For the store nearest you, call 800-753-5766

© 1992 CompuAdd Computer Corporation. Prices and product description numbers are subject to change without notice

CompuAdd
CUSTOMER DRIVEN, BY DESIGN.

CompuAdd is not liable for damage due to omissions or typographical errors. Call 800-666-1872 for a copy of CompuAdd's complete warranty.

1-800-289-9888

Key Code 816
CIRCLE 126 ON READER SERVICE CARD

Read Only

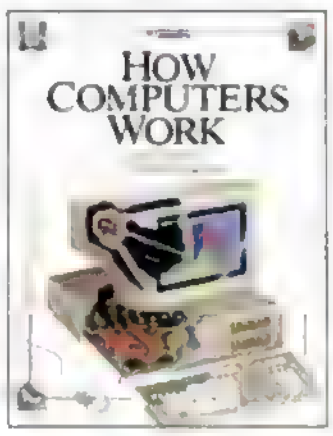
REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Carol Levin

An Incredible Visual Journey Inside the PC

BY ALFRED POOR

"Any sufficiently advanced technology is indistinguishable from magic," said science fiction writer Arthur C. Clarke. So begins *How Computers Work*, Ron White's illustrated journey inside the PC in which he demystifies the inner secrets of our desktop computers and their components, from disks to printers to system caches to networks.



The book's contents are drawn from the "How It Works" column in *PC/Computing* (where White is an executive editor), which in turn pays homage to David Macaulay's landmark *The Way Things Work*. Both tackle technical topics and explain them in ways that people without engineering degrees can understand.

You will not find hands-on guidance for repairs, upgrades, or troubleshooting sessions, but you will find White's words backed up by some of the most elegantly simple, computer-generated technical drawings you could ever hope to find. Falling into the trap in which pictures become more important than the concepts they're meant to represent is easy, but this book masterfully steers clear of that problem.

Much of the artwork depicts physical components and procedures in a simplified, schematic manner. For example, the eight-step representation of booting from a disk shows the roles played by BIOS chips, CPU, different segments of the disk's data storage area, and memory. Through a series of carefully labeled illustrations and brief captions, the process is broken down into easily digestible concepts.

Some concepts do not lend themselves readily to illustrations of real components, but White's approach shifts to handle these with equal clarity. For example, the section on how data is written to and read from memory chips relies on a schematic of colored pipes, indicating the flow of electrical pulses. While the illustration does not look like the inside of a RAM chip, it does an excellent job of conveying how the chip operates.

As an enjoyable way to learn what makes your system tick, nothing comes close to *How Computers Work*. Browse through it for an entertaining and informative diversion, or work your way through from cover to cover for a thorough orientation. And when you're finished, don't hide it away on some remote shelf—leave it out on your coffee table where everyone can enjoy this beautiful book. □

• **How Computers Work,** *by Ron White, illustrated by Timothy Edward Downs, $22.95. Ziff Davis Press, 5903 Christie Ave., Emeryville, CA 94608; 800-688-0448. ISBN: 1-56276-094-7.*

Circle 465 on reader service card

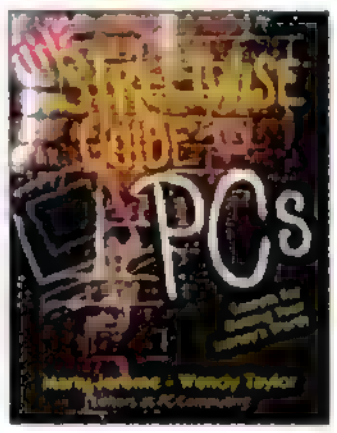
Tough-Minded Buying Tips

BY JONATHAN MATZKIN

The recent free-fall in PC prices has attracted large numbers of users who stayed on the sidelines of the information revolution until PCs became commodity items like VCRs or CD players. These newcomers have to stare down the hype that surrounds PC technology, decipher ads that bulge with intimidating jargon, and somehow choose from a daunting range of hardware and software.

The Streetwise Guide to PCs, by *PC/Computing* editors Marty Jerome and Wendy Taylor, aims to guide computer buyers by debunking common myths and offering tough-minded advice on what to buy and how to buy it.

In a highly readable and witty tone, they provide solid, specific help with evaluating needs and buying the right equipment at the right price. They take a refreshingly antagonistic stance when pointing out how advertisers and the media mislead consumers. "The first thing to look for in an ad or brochure is a full mailing address. If none exists, turn the page," they warn in a guide to the fine print in mail-order ads.



But Jerome and Taylor also oversimplify some important technical concepts and turn gratuitously snide at times. One particularly distasteful turn of phrase refers to successful software publishers as "a handful of unlikely social misfits."

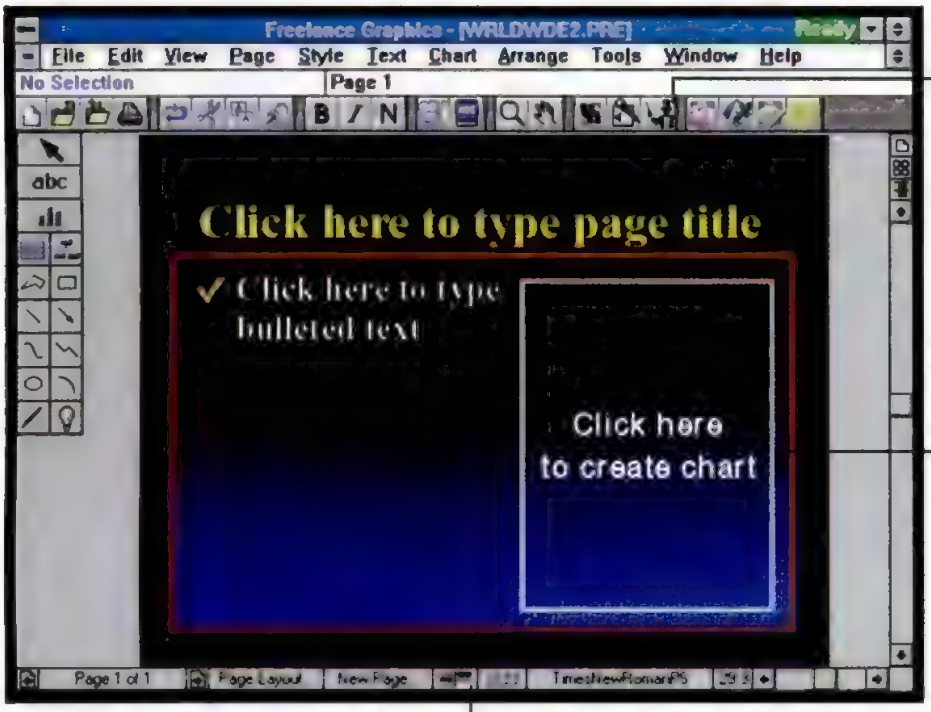
Such outbursts somehow undermine the credibility of the more worthwhile material, of which there is plenty. Three chapters make up a well-presented tutorial on the art of buying a PC through retail stores and mail-order companies, as well as the used-equipment market. The excellent advice ranges from tips on testing used equipment ("Look for the four-digit number on the chips' labels—the first two digits indicate the year they were manufactured.") to pointers on negotiating a fair price ("A good place to start is 25 percent to 30 percent of the original price; 15 percent off the sticker price is not a bad place to end.") Each chapter ends with a checklist of key concepts that will keep a buyer focused on important issues such as service, support, and vendor reliability.

To their credit, the authors urge users to make informed choices and to be skeptical of conventional wisdom. They back up these abstract principles with concrete instructions on acquiring a PC. But some of their more excessive language (computer literacy is a "vapid notion") has to be filtered out in order to take best advantage of this guide. □

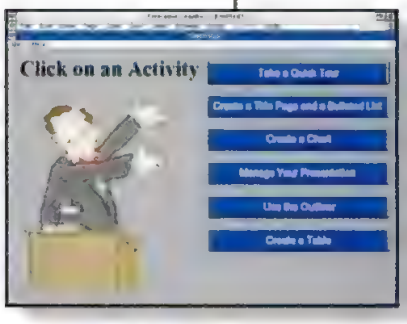
• **The Streetwise Guide to PCs,** *by Marty Jerome and Wendy Taylor; $14.95, Addison-Wesley Publishing Co., P.O. Box 2468, Reading, MA. 800-447-2226. ISBN: 0-201-60839-1.*

Circle 466 on reader service card

New Freelance Graphics 2
(Especially the decision t

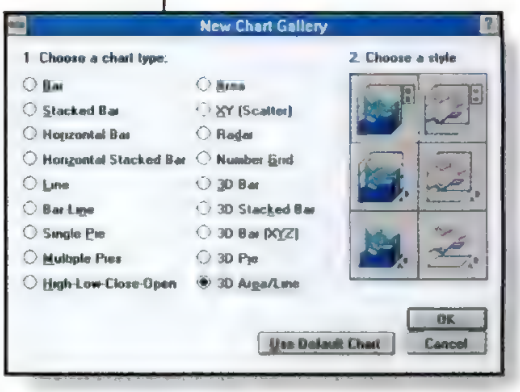


Single-click access to powerful presentation tools makes Freelance Graphics easy to use.



Just click to view the animated QuickStart tutorial. It walks you through your first presentation in under 30 minutes.

Just click to instantly see your presentation in color or B/W. It's automatically optimized for printing both.



Just click to browse through a gallery of 108 ready-to-go chart styles including new 3-D line, 3-D area and radar selections.

© 1993 Lotus Development Corporation, 55 Cambridge Parkway, Cambridge, MA 02142. All rights reserved. Lotus and Freelance Graphics are registered trademarks and SmartSuit
Harvard Graphics is a registered trademark of Software Publishing C

.0 makes everything easy. o leave Harvard Graphics.)

If you've been using Harvard Graphics® for DOS, maybe it's time to make a change.

Introducing Freelance Graphics For Windows,™ Release 2.0.

The first release of Freelance Graphics™ won every major award in the presentation graphics category in 1992. And users agreed in two recent studies by the Usability Sciences Corporation that Freelance Graphics was easier to use than Harvard Graphics for Windows or Microsoft® Powerpoint® 3.0.

Now, in Release 2.0, we've built on the innovations of the first release, adding many ease-of-use enhancements and exciting new capabilities. And we subjected every enhancement to rigorous usability testing. The result is the fastest, friendliest, and most intuitive presentation software available today.

Our free, full-featured working model will prove that it's time to switch to Freelance Graphics 2.0.

There's No Easier, Faster Way To Create Presentations.

Only Freelance Graphics includes SmartMasters,™ which automatically guide you through every step of the design process. All you do is select the look you want for the entire presentation, choose a page layout, and fill in the blanks. It's that easy. And now, to give you even more possibilities, Freelance Graphics offers more SmartMaster designs and page layouts than ever before.

Other new enhancements include: full functionality for tables and organization charts; Speaker Notes; special text effects such as automatic build slides; Screen Show features like branching; multimedia capabilities; and easy import of your files from Harvard Graphics for DOS (Versions 2.3 and 3.0).

Release 2.0 has already won PC Computing's coveted MVP Award.

If You're Using Harvard Graphics, Make The Switch Now.

Call **1-800-872-3387, ext. 8420** for your free, full-featured working model, and ask about our special competitive upgrade price. And remember that Freelance Graphics is included in Lotus® SmartSuite:™ four award-winning Windows applications at a great price.

Lotus **Freelance 2.0**

Presentation Graphics for Windows

e and SmartMasters are trademarks of Lotus Development Corporation. Microsoft and Powerpoint are registered trademarks and Windows is a trademark of Microsoft Corporation. orporation. Offer valid in U.S. only. In Canada call **1-800-GO-LOTUS.**

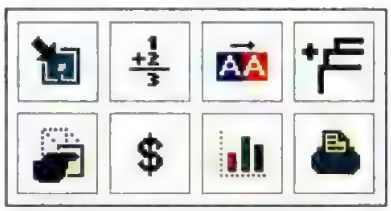
You'll find our new 1-2-3 for

Introducing the fastest graphical DOS spreadsheet. As you might expect, it's from Lotus.®

1-2-3® Release 3.4 will let you experience unheard of power and ease of use at speeds that leave the competition behind.

Shift into high gear.

For people who are committed to DOS, 1-2-3 Release 3.4 is going to pump a little excitement into the relationship.



Only 1-2-3 has SmartIcons that let you execute over 90 different commands with a single click.

Compared to past releases, the speed improvements in key functions like product load, print, display, and recalculation are significant. And compared to Quattro® Pro 4.0, Release 3.4 cuts the file retrieve time practically in half and significantly reduces the time to move a block of data, print and calculate.*

But this new release doesn't just break speed records. It makes operating your DOS spreadsheet easier than ever.

Fly through multiple functions with SmartIcons.

1-2-3 Release 3.4 comes equipped with over 90 SmartIcons,™ including 12 customizable icons that give you one-click access to your macros whenever you want it. SmartIcons give you quick single-click access to your most commonly used spreadsheet commands, including

*NSTL standards used in tests performed at Lotus on a Compaq

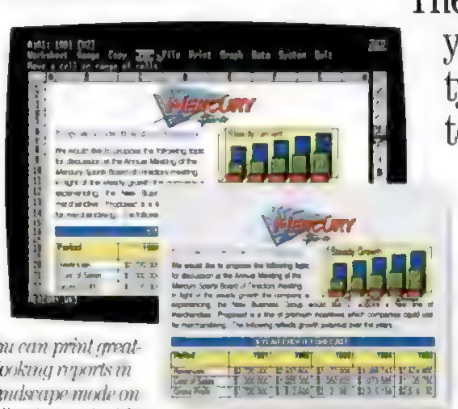
©1993 Lotus Development Corporation, 55 Cambridge Parkway, Cambridge, MA 02142. All rights reserved. Lotus, 1-2-3 and DataLens are registered trademarks and SmartIcons is

DOS a moving experience.

3D SmartSum, printing, formatting, graphing and saving a file.

A more powerful way to analyze numbers.

As the only true 3D spreadsheet for DOS, 1-2-3 Release 3.4 not only lets you organize and consolidate data in ways you've never seen before, it makes it easy.



You can print great-looking reports in landscape mode on all printers. And fast.

You can also take advantage of other innovative features including DataLens® external database access, Solver goal-seeking technology, file Viewer for previewing files, Auditor to let you look into the logic behind the formulas you create, new 3D and table chart graphs and setting sheets.

Then, when you want to print your worksheet, you can mix typestyles and attributes for terrific looking reports.

Visit your Lotus Authorized Reseller, or call **1-800-TRADEUP, ext. 8416**** today to order your upgrade. And experience DOS as you've never experienced it before.

Lotus 1-2-3 for DOS

386/16-4 megabytes. **In Canada, call **1-800-GO-LOTUS.**
a trademark of Lotus Development Corporation. Quattro is a registered trademark of Borland International, Inc. The Norton Desktop is a trademark of Symantec Corporation.

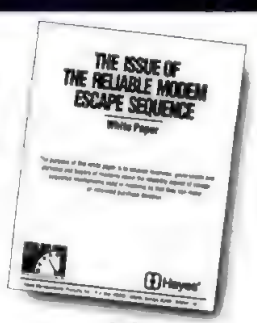
A New Corporate Downturn Caused By Interrupted Modem Transmissions.

Your daily business routine could be turned upside down by an interrupted modem transmission. One moment you're sending or receiving data, the next moment you're fuming. Has the Escape Sequence used by your modem just interrupted your transmission?

While our real world examples of interrupted transmissions due to escape sequences have been limited to our BBS and Hayes' own data files, our analysis is based on the theoretical possibility that you can experience this situation in your business. Will you be the one who proves our theory?

ONE WAY TO AVOID TRANSMISSION FAILURE. The Hayes Improved Escape Sequence With Guard Time, the industry-standard patented technology that's proven reliable for over a decade, is one way to count on reliable data transmission. You'll find it in all Hayes modems and in other licensed modems that have this symbol on their packaging. Although it doesn't mean full Hayes compatibility, it does ensure that products displaying this symbol use the patented Hayes technology.

THE WHITE PAPER. We've developed an informative White Paper titled "The Issue Of The Reliable Modem Escape Sequence."



The paper discusses escape sequences and these possibilities. For a ***FREE*** copy, call 800-374-8388, FAX your request to 404-729-6650, or download the paper from the Hayes BBS. Call or fax us today for your copy of the White Paper. Because your world is hectic enough without being ambushed by a modem with an attitude.

Hayes

Why settle for anything less? Hayes products have the computer world talking. More than ever.

Go *Online with Hayes* BBS; call 800-874-2937 or 404-446-6336

©1992 Hayes Microcomputer Products, Inc., P.O. Box 105203, Atlanta, GA 30348

CIRCLE 136 ON READER SERVICE CARD

Toolkits

REVIEWS OF THE LATEST TOOLS FOR THE PC PROGRAMMER

Edited by Trudy Neuhaus

Paradox Engine 3.0: A Step Toward IDAPI

BY RICHARD HALE SHAW

Until recently, software developers found object-oriented DBMSs to be little more than hype. But with the appearance of Raima's Object Manager and Object Design's ObjectStore, reality set in. Now Borland International has delivered its object-oriented Database Framework as part of the Paradox Engine 3.0.

The $299.95 Paradox Engine, Version 3.0, is priced nearly $200 less than previous versions, yet it still lets you create royalty-free database applications. While it's designed for use with Borland C++ 3.*x*, Microsoft C 6.0 or later, or any of Borland's Pascal with Objects languages, the fact that the Windows Engine is a DLL means you should be able to use it with other Windows development languages (such as Visual Basic) even if they are not explicitly supported.

Version 3.0 includes everything you need in order to write Paradox 3.5- and 4.0-compatible applications for DOS, Windows, and networked environments. Its Paradox 4.0 support gives you improved file- and record-locking services, use of Paradox 4.0's composite indexes, and a function to upgrade a Paradox 3.5 table to 4.0's format. Plus, the 3.0 Engine offers broader Pascal support: You can use standard overlays and create DOS protected-mode programs with Borland Pascal 7.0.

The Engine API has grown from around 70 functions to over 90 with Version 3.0. The additions include BLOB (binary large object) support, faster raw data transfer functions (in case you don't want to retrieve a record field by field), and case-insensitive search functions. BLOBs are the same as in Paradox 4.0: They can be any data type including graphics, bitmaps, and formatted or unformatted text; each BLOB field is a pointer to BLOB data in an .MB file that can contain up to 256MB of BLOB data; and you can maintain a brief header for each BLOB in the main table (for storing keywords or formatting information). However, BLOBs can only be read in chunks slightly smaller than 64K: the API should but doesn't contain functions that encapsulate BLOB operations.

But the big news is the Database Framework for C++ and Pascal. It is the Paradox-specific portion of Borland's IDAPI strategy. The Database Framework is an object layer and virtual table structure that hides the connections to drivers for specific data file formats. The idea is that if a database engine is available for a specific format, you'll be able to use the Framework with more than one type of database. For the time being, only Paradox support through the Paradox Engine is available.

The Database Framework turns the Paradox Engine into an object-oriented database class library, so that instead of creating and manipulating tables, records, and handles, you create objects whose member functions are capable of performing complex database operations for you. All the member functions or methods in the Framework are virtual, so you can override them and change the behavior of classes at runtime. Finally, the classes often contain information that the Engine requires (such as table handles and record handles), so you don't have to pass it to member functions. The result? A cleaner, clearer, more conceptual approach to writing database applications than if you used the Engine by itself.

While it's easy enough to write database applications with the Engine, the Database Framework is chockfull of useful goodies that make the job even easier. For instance, each class offers a printOn member function that lets you direct the output of Engine information (such as the class name and the names of data members) to a particular I/O stream. But perhaps the best and simplest features are the preprocess and postprocess virtual member functions found in the BRecord class: You can override these to perform field validation and to create derived fields before and after a record is retrieved and posted.

When compared with products like Raima's Object Manager, however, the Database Framework is too Paradox-specific, and simply doesn't take advantage of all the OOP capabilities of C++: I would have liked to have seen greater use of operator overloading to ease table navigation, and additional abstraction to let you treat a database table as simply an array of objects.

In addition, things I cited as problems with Version 1.0 (First Looks, April 10, 1990) are still problems in Version 3.0: that the Engine offers no API function for sorting a table, forces developers to use the large memory model, doesn't make it easy to implement Paradox-style auto-refresh in an application, and couldn't use stored QBE and SQL queries while Paradox could.

Unfortunately, that's not all: While the 2.0 Engine added 50K to 100K to any application's size, the 3.0 Engine adds closer to 150K. Finally, on certain operations the 3.0 Engine is over 40 percent slower than the 2.0 Engine. While a decrease in performance is disturbing, it's more unsettling in view of the fact that Paradox 4.0, built with the 3.0 Engine, was significantly faster in our benchmark tests (First Looks, November 10, 1992) than Paradox 3.5, which was built with the 2.0 Engine. What's in Paradox that's not in the Engine? In short, if you're currently developing applications with the Paradox Engine, you'll appreciate 3.0's features, and at $299.95, newcomers will find plenty of bang for the buck. But if you need to build a full-featured, object-oriented DBMS, Paradox Engine isn't your best bet.

• Paradox Engine, Version 3.0, and Database Framework
List Price: *$299.95; upgrade, $169.90.* Requires: *IBM or compatible PC, DOS 3.1 or later, 4MB disk space, 512K RAM. Borland International, 1800 Green Hill Rd., Scotts Valley, CA 95067-0001; 408-438-8400.*
Circle 451 on reader service card

LOOKS LIKE A WIN WIN WIN WIN SITUATION.

Dell has a complete line of award-winning notebooks.
Which means at prices like these, you can't lose.

DELL™

800-626-4380

WHEN CALLING, PLEASE REFERENCE **#11BDH**.
HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN.
IN CANADA, CALL 800-668-3021. IN MEXICO CITY, 228-7811.

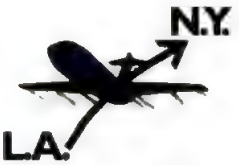
*Guarantees available in USA only for registered owners of Dell 78759-7299. Attention Guarantees. †Rapid Response return-to-areas. The Intel Inside logo is a registered trademark and i386 is a 500 is a registered trademark of The Time Inc. Magazine Company.

THE DELL® 325NC
i386™ SL 25MHz
COLOR NOTEBOOK

NOW $2,349

- LEASE*: $87/MO.
- 4MB RAM
- 80MB (19ms) HARD DRIVE
- VGA COLOR LCD (9", 640 x 480)
- 7.1 LBS. (INCLUDING BATTERY)
- 8.5" x 11" x 2.3"
- NiMH BATTERY
- 3-HOUR BATTERY LIFE, UP TO 5 HOURS WITH POWER MANAGEMENT ENABLED
- MS-DOS® 5.0

260,000 colors.
At your disposal is every color of the palette, and then some. If Van Gogh had one of these, maybe he wouldn't have been so uptight...



Long battery life.
The good news is the battery can hold out flying all the way from L.A. to N.Y. The bad news is, who wants to work all the way from L.A. to N.Y.?

Greater upgradeability.
Along with the special Intel chip made specifically for notebooks, there's also room for a modem, coprocessor, 200MB hard drive and up to 12MB of RAM.

THE DELL 325N
i386 SL 25MHz
NOTEBOOK

NOW $1,849

- LEASE: $68/MO.
- 4MB RAM
- 80MB (19ms) HARD DRIVE
- EDGELIT VGA LCD (9.5", 640 x 480)
- 6.4 LBS. (INCLUDING BATTERY)
- 8.5" x 11" x 2.1"
- NiMH BATTERY
- 3-HOUR BATTERY LIFE, UP TO 5 HOURS WITH POWER MANAGEMENT ENABLED
- MS-DOS 5.0

Guaranteed Response.
We guarantee that when you call us, you'll talk to a technical specialist within five minutes or less. And that in the unlikely event you have compatibility problems, we'll help you solve them.*

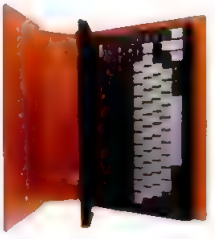
Large storage capacity-200MB drive available.
With all its storage, this little notebook makes the Astrodome seem positively cramped.

Two-thirds of the FORTUNE 500° are Dell customers.
By the way, those FORTUNE 500 customers are the ones who vote us number one in customer satisfaction surveys.

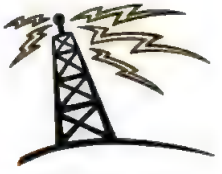
THE DELL 320SLi
i386 SL 20MHz 3.6 LB.
NOTEBOOK

NOW $1,699

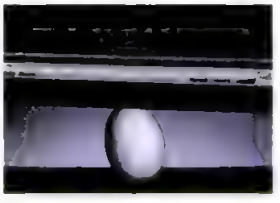
- LEASE: $63/MO.
- 2MB RAM
- 60MB (19ms) HARD DRIVE
- REFLECTIVE VGA LCD (9.5", 640 X 480)
- 3.6 LBS. (INCLUDING BATTERY)
- 7.75" x 11" x 1.25"
- NiMH BATTERY
- 3-HOUR BATTERY LIFE, UP TO 4 HOURS WITH POWER MANAGEMENT ENABLED
- MS-DOS 5.0
- MICROSOFT® WINDOWS™ 3.1
- LOTUS® ORGANIZER



Only 1.25" thick.
We call it a notebook, but it's actually smaller. Punch a few holes in it and you could carry it in a 3-ring binder.



Stay in touch.
It has an industry-standard PCMCIA type 2 expansion slot for modems and network cards. It's like taking your office with you. Only without the secretaries and coffee machines.

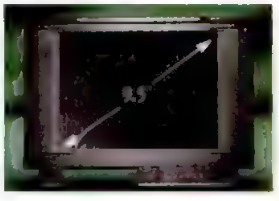


3.6 pounds.
At a mere 3.6 pounds, it offers features and functions usually reserved for systems twice its weight.

THE DELL DIMENSION™
NL25† i386 SL 25MHz
NOTEBOOK

NOW $1,599

- LEASE: $59/MO.
- 2MB RAM
- 80MB (19ms) HARD DRIVE
- EDGELIT VGA LCD (9.5", 640 x 480)
- 6.3 LBS. (INCLUDING BATTERY)
- 8.3" x 11" x 1.8"
- NiCAD BATTERY
- 2.5-HOUR BATTERY LIFE, UP TO 3.5 HOURS WITH POWER MANAGEMENT ENABLED
- MS-DOS 5.0



9.5" screen.
Ever want to see your work up on the big screen? All it takes is a small-screen budget.

Full keyboard.
Your hands don't get smaller just because your computer does. So Dell gave it a full-size, full-travel, 85-key keyboard, including special screen navigation keys in the familiar inverted-T layout.

ALSO AVAILABLE:
THE DELL DIMENSION
NL20† i386 SL 20MHz
NOTEBOOK

$1,399

- LEASE: $52/MO.
- 2MB RAM
- 60MB (19ms) HARD DRIVE
- EDGELIT VGA LCD (8.5", 640 x 480)
- 6.3 LBS. (INCLUDING BATTERY)
- 8.3" x 11" x 1.8"
- NiCAD BATTERY
- 2.5-HOUR BATTERY LIFE, UP TO 3.5 HOURS WITH POWER MANAGEMENT ENABLED
- MS-DOS 5.0

*Performance Series systems purchased after 7/1/92. For a complete copy, please call our TechFax™ line at 1-800-950-1329 or write Dell USA L.P., 9505 Arboretum Blvd., Austin TX 78759-7299. *Factory service only for NL20 and NL25 notebooks. °Leasing arranged by Leasing Group, Inc. *On-site service provided by BancTec Service Corporation. On-site service may not be available in certain remote locations. †Intel Corporation. MS-DOS and Microsoft are registered trademarks and Windows is a trademark of Microsoft Corporation. Lotus is a registered trademark of Lotus Development Corp. FORTUNE is a trademark of Time Inc. Dell disclaims proprietary interest in the marks and names of others.* *©1993 Dell Computer Corporation. All rights reserved.*

Software

Accounting

CA-Simply Accounting Win/DOS	109
Intuit QuickBooks (Special)	89
Intuit Quicken Win v2.0	39
MS Money Win v2.0 (Special)	15
Peachtree Complete v6.0	169
Reality Tech Wealthstarter v2.0	25

Box Graphics

ABC Flowcharter 2.0 Windows	269
Aldus Persuasion v2.1 Windows	309
Arts & Letters Apprentice	79
Arts & Letters Picture Wizard	49
CA-Cricket Presents (Special)	109
Corel Draw v3.0 Dsk & CD	369
Corel Draw Dsk & CD Comp Upgrade	169
Graphic Works	179
Lotus Freelance Graphics Win	299
Micrografx Windows Draw (Special)	89
Power-Up! Calendar Creator Plus v5.0	39
SW Harvard Graphics for Win v1.02	349
SW Publishing Harvard Graphics v3.0	399

CAD

American Design CAD v4.0 3D	229
American Design CAD v5.0 2D	159
Autocad Release 12	2895
Autodesk Autosketch v3.0 (Special)	89
Autodesk Generic CAD v6.0	269
Autodesk Generic CAD Symbol Libraries Architect 1&2, Engineering & Electronic Symbols	59
Autodesk Generic CAD Symbol Libraries	
Business Symbols (Special)	37
Foresight Drafix Windows Cad v2.1	419

Communications

Datastorm Procomm Plus for Windows	95
Datastorm Procomm Plus v2.01 (Special)	69
Hayes Optima 24/SCEZ v 42Bis	119
Hayes Optima 96/SCEZ (Special)	329
Hayes Smartmodem 24/SCEZ	249
Hayes Ultra 96/SCEZ v 42Bis	529
Intel Satisfaxtion 14.4 Fax/Data	399
Intel Satisfaxtion 9600/2400 mod 100	99
Microcom Carbon Copy Plus v6.1	119
Practical PM9600SA v 42Bis (Special)	289
Smartcom for Windows	95
Symantec Norton PCAnywhere LAN v4.5	299
U.S. Robotics Cour HST DS v 32BIS EXTL	879
U.S. Robotics Cour v.32 14.4 EXTL	439
U.S. Robotics Cour v.32BIS 14.4 Fax EXTL	459
Zoom 2400BPS w/RPI Hrdwr EXTL	59

Database

Alpha Four 2.0 Comp Upgrade (Special)	89
Borland dBASE III Plus v1.1	459
Borland dBASE IV v1.5 (Special)	509
Borland Paradox v4.0	499
Claris Filemaker Pro Win v2.0	249
DB Fast	329
Microrim R:BASE v4.0	439
MS Access Win v1.0 (Special)	89
SuperBase IV Windows v1.3	459
Symantec Q&A v4.0	249
Word Tech Arago dBXL v2.5	599
Word Tech Arago Prof. v2.5 (Special)	699

Desktop Publishing

Adobe Illustrator v4.0/Win	409
Adobe Type Fonts (Special)	Call
Adobe Type Manager Plus Pk	119
Aldus Freehand Win v3.1	389
Aldus Gallery Effects Win (Special)	129
Aldus PageMaker v4.0 Win	478
Caere Omnipage Pro Win v2.1	599
Corel Draw v3.0 Trade Upgrade	169
DeskTop Styles	25
Micrologic Marellants v3.0 (Special)	69
Microsoft Powerpoint v3.0 Win	289
Microsoft Publisher for Win v1.0	115
Microsoft True Type Fonts Pack	64
Quark Xpress Win (Special)	519

Home/Recreation

Access Links 386 Pro (Special)	32
Accolade Hardball III	32
Accolade Jack Nicklaus Signature Ed.	37
Broderbund New Print Shop Companion	29
Broderbund Where in the USA	29
Broderbund Where in Time	29
Davison & Assoc. New Math Blaster Plus	29
Gamelok Wheel of Fortune/Win	21
Meca The Oregon Trail (Special)	29
Meca Word Munchers	15
MS Flight Simulator v4.0	37
MS Golf (Special)	42
Psygnosis Lemmings	26
SMC Automap Europe (Special)	69
SMC Orbits (Special)	29
Walt Disney Bundle	35

Intergrated

Lotus Smart Suite (Special)	425
Lotus Works	89
Microsoft Office for Win v3.0	439
Microsoft Works for Win v2.0	119
Microsoft Works v3.0 (Special)	89

Operating Sys.

Digital DR DOS v6.0 (Special)	68
IBM OS/2 v2.0/Upgrade	99
Microsoft DOS v5.0 Upgrade	69
Microsoft Win. 3.1 (Special)	88
Microsoft Win. 3.1 Upgrade	47
Novell Netware Lite v1.1	65
Qualitas BlueMAX v6.0 (Special)	79
Quarterdeck Desqview 386 v2.4	119

Programming

Borland C++ v3.1 w/App Fram v3.0	489
Borland Turbo C++ for Windows v3.1	99
Borland Turbo Pascal v7.0	99
CA Clipper v5.2 (Special)	449
Microsoft C Compiler v6.0	299
Microsoft Fortran Compiler v5.1	289
Microsoft Visual Basic Win v2.0	119

Utilities

Berkley Syst After Dark for Win v2.0	27
Central Point PC Tools v8.0	125
Central Pt PC Tools LAN 25 Pk. v7.1	2149
Gold Disk Screen Craze (Special)	15
Qualitas 386 Max v6.0 (Special)	59
Quarterdeck Qemm 386 v6.0	59
Stac Software Stacker MC/16 (Special)	199
Stac Software Stacker v3.0/Win	89
Symantec Norton Antivirus v2.1	79
Symantec Norton Desktop for Win v2.0	117
Symantec Norton Utilities v6.01	110

The CallSoft Value:

- Over 10,000 Stock Items
- Expanded International Distribution
- Same Day Shipping
- No Credit Card Surcharge
- Corporate P.O., A.P.O., F.P.O. and Int'l Orders Welcome
- 24 Hour Automated Order Line

CallSoft

Est. Since 1982

TO ORDER CALL 1-800-777-5014

Software and Peripherals at Best Prices and Full Service

INTERNATIONAL CALLERS USE

1-908-805-0995

(Mon-Fri 8:00AM - 8:00PM EST)

OVER 10 DISTRIBUTION CENTERS NATIONWIDE

Soundman 16 16 Bit, CD Quality Stereo Sound, Midi Joystick Port, Voice Synthesis and adio mixer 100% Sound blaster Ad lib Win 3.1 and DOS com- patible ready to run with all games

$189

Replacement of defective items. There is a 15% restocking fee on any non-defective, unopened goods returned. Software/Hardware prices may change without notice. $7.50 for 2-day, $35.00 for overnight. Small handling charge applies. Not responsible for typographical errors.

Arts & Letters Graphics Editor v3.12 - The Arts & Letters Graphics Editor is the choice drawing/ illustration program in over 50 countries! Use its 8000 images, 90 typefaces, and 4-color separation features for your next publishing product Order Now!

$329

Audioman -Compact Digital Audio Tool allows you to easily add verbal annotations to spreadsheets, E mail or any OLE, Win 3.1applicat ions Plug into par port - includes built -in mike, speaker and ext output jack

$149

Stacker v3.0 New Stacker 3.0 for Windows and DOS enances Stacker's disk doubling with increased performance, password security and new tools that monitor and tune your system Plus more!

$89 Comp. Upgrade $45

Discovery TrueType Pak More than "Fonts-in-a Box" Includes 46 TrueType fonts, 1000+ Clip-Art images, 8 pre-formatted document templates, and on-line Windows Font Usage Guide

With purchase of any Windows product $34

$39

Lotus Ami Pro 3.0 - It's simple New Ami Pro release 3.0 is the Windows word processor that will make your work dramatically easier - and better looking than ever So you can create letter-perfect, picture-perfect documents in half the time, with half the effort

$249

Microsoft Fox Pro for Windows v2.5 First Windows DBMS taking full advantage of Windows by using the w ndows fonts, by supporting OLE, DDE DLL calls, graphics, color and by using standard dialogue boxes

$309

Please call for any item not listed. We have an extensive inventory to cover all your needs. We're a Novell & Lotus authorized dealer

VISA MasterCard DISCOVER

CIRCLE 190 ON READER SERVICE CARD

Spreadsheets

Borland Quattro Pro v4.0 Comp Upgrade	89
CA-Complete! v4.2	299
CA Supercalc v5.5 (Special)	89
CA-Superproject v2.1	499
Lotus 1-2-3 for Win v1.1 Comp Upgrade	95
Lotus 1-2-3 for Windows v1.1	289
Lotus 1-2-3 v3.1+ (Special)	389
Microsoft Excel v4.0 for Win (Special)	295

Word Proc.

CA Textor	75
Individual Software Resumemaker	29
Lotus AmiPro v3.0 Upgrades (Competitive)	89
Lotus AmiPro v3.0 & 1-2-3 v1.1 for Win	189
Microsoft Word for Win v2.0	289
Que Soft Rightwriter v6.0 Win (Special)	59
Reference Grammatik 5 DOS or Win	69
Software Pub. Corp. Prof Write v2.2	169
WordPerfect for Win v5.2 (Special)	269
WordPerfect v5.2 Upgrade (Various)	Call

Peripherals & Hardware

Accessories

3M DC2 120 Data Cart	21
American Power Conversion Back-Ups 250	109
Kensington Masterpiece (Special)	89
Logitech Dasxa Mouse w/9-25 Pin Adapter	19
Logitech Mouseman Bus (Special)	69
Logitech Mouseman 5 pak	269
Microsoft Bus Mouse w/Win Ser PS/2 Bus	147
Tripp Lite Isobar4 (Special)	45

CPU's

ALR PowerFLEX 386SX 25MHz	789
PS/2 (Special)	Call
Wyse 386SX/25C	Call

Connectivity

3 Com EtherLink II TP Adapter (Special)	215
Eagle Tech NE 1000 Ethernet Card 8bit/noCbl	94
Eagle Tech NE 2000 Ethernet Card 16bit/no Cbl	169
Stand Micro Sys Ethercard Elite16 Combo	169
Stand Micro Sys Ethercard PlusElite 16T	189

Monitors

ATI VGA Wonder XL24	139
Goldstar 1460 Plus 14"	279
Magnavox Super VGA 14"/ 28	309
NEC MultiSync 3FGX Flat Screen 15"	659
NEC MultiSync 2A 14" Super VGA	399
NEC MultiSync 4FG Flat Screen 15"	759
Packard Bell PB853 1VG 14" VGA	329
Samsung CVL4955 14"	219
Samsung ML4571 14" VGA White	119
Samsung Syncmaster 4 17" Super VGA	759

Multimedia

Creative Labs Int CD-ROM SoundBlaster Pro MS Win 3.1, Speakers Model 200	459
Creative Labs Ext CD-ROM, SoundBlaster Pro MS Win 3.1, Speakers Model 200	519
Lab Tech Stereo Speakers 100 (Special)	16
Lab Tech Stereo Speakers 200	19
Sound Blaster (Mono) Joystick port MIDI	95
Sound Blaster (Stereo) Joystick port MIDI	189
Sound Blaster MIDI Kit (Special)	59

Storage/Drivers

Creative Labs CD-ROM Kit Int (Special)	359
Creative Labs CD-ROM Kit Ext (Special)	439
Colorado Mem Systems Jumbo 250MB	259
Iomega Transportable 90 Pro External	649
Irwin 250MB Dual Speed Int/Kit	299
Magnavox CM205X8K CD-ROM w/Audio	359
Quantum Hardcard IIXL 105MB	449
Seagate ST3144A 130MB 3.5 IDE	289
Sydos 88IL Internal Removable Cat	519
TEAC 3.5" 1.44MB Floppy Disk Drive	59
TEAC 5.25" 1.2MB Floppy Disk Drive	59
Toshiba 1.2MB 5.25 Floppy	69

Printers/Scanners

Canon BJ 10EX Gry/Wht (Special)	299
Canon BJ 300 80 Col 24 Wire	429
Fotoman Plus Upgrade Kit	249
Kodak Diconix 180si Printer Par	399
Kodak Mpower Mac Inter Kit	39
Kodak Diconix 180si Serial (Special)	419
LaserMaster Winjet 300	369
LaserMaster Winjet 800MCA	579
Logitech Scanman 256	256
Logitech Scanman 32	125
Okidata ML 320 Printer (Special)	359
Okidata ML-380 Printer	219
Okidata OL-400P Printer	599
Okidata OL-830 Printer (Special)	1299
Okidata OL-840 Printer	1599
Panasonic KX-P1 1241 24 Pin/80 Col	299
Panasonic KX-P1 180i	149
Panasonic KX P1654 Dot Matrix	559
Panasonic KX P2624 Quiet Tech	379

OVER 10,000 ITEMS • 2 RIVERVIEW DR • SOMERSET, NJ 08873 • FAX (908) 302-9730

Michael J. Miller

The Next Software Revolution

If you think the transition from text-based programs to graphical operating systems was a big deal, you ain't seen nothin' yet. Wait until the computer industry moves from application-based computing to document-oriented computing. Instead of worrying about which program to use, you'll think about the document you want to create—be it a letter, report, spreadsheet, or drawing—and then bring to it all the tools you'll need to build it.

The result promises to be a whole new way of looking at software, and features such as Microsoft's Object Linking and Embedding (OLE), IBM's System Object Model (SOM), and Apple's Open Collaborative Environment (OCE) are leading the way. These operating environment components are designed to take us to a fully distributed, object-oriented approach to using computers. (For more information in this area, see this issue's cover story, "Application Integration: Making Your Programs Work Together.")

Object-oriented technology will let you combine tools so that the whole is greater than the sum of the parts. On the simplest level, you'll be able to have a single document that contains text, graphics, and spreadsheet portions, and each portion will be edited by the proper tool. Move the cursor to the text, and the word-processing menus will appear. Click on the graph, and charting tools will appear. That's a level of application integration we haven't seen to date, and it should make computing much more powerful.

But that's just the beginning. You'll have less duplication between programs and more freedom to assemble components into a solution that is right for you. You'll be able to pick one spell checker and have it work in all of your applications, from word processing to presentation graphics to spreadsheets. It might even be possible (though perhaps not practical) to combine the text editor from Microsoft Word, the spell checker from Ami Pro, and the search-and-replace engine from WordPerfect. You could replace one tool with another or add tools that are specific to your needs.

MIX-AND-MATCH FEATURES

Someone who works with illustrations might replace the limited drawing module that accompanies a word processor with the more sophisticated CorelDRAW, Micrografx Designer, or Adobe Illustrator. An engineer might replace the "equation editors" with MathCad, Mathematica, or Maple, which can actually evaluate equations.

Let's take it a step further. A bank could have a loan application form letter with a mortgage-analysis module. Or is that a loan-analysis worksheet with a text-editing module? It might be hard to tell. A legal office might have its briefs set up so lawyers could click on a citation and have the original case law pop up. A stockbroker might have a constant stream of current pricing moving into an analysis spreadsheet.

The software industry has a lot to do before all this actually works, of course. To begin with, the specifications aren't completely finished, and the tools that developers need to write such applications aren't ready. It would be great, in the long run, if we had enough tools so that the professional developer and sophisticated end user alike could create components. Before this happens, though, we'd need more features in everything from C++ compilers to macro languages.

If and when the components really start working together, there's the question of how we'll obtain these tools. We're used to paying a couple of hundred dollars for a word processor (or less for an upgrade), but how much is a search-and-replace mod-

With any luck, you'll soon stop thinking about "applications" and start thinking about "documents."

Illustration by Nishan Akgulian

ule worth? No one knows. For a long time, I suspect, we'll be buying collections of these tools—word-processing packages that consist of text editors, search-and-replace functions, spell checkers, mail-merge features, table tools, grammar checkers, and so on.

Once you get beyond those basic combinations, though, who will distribute and assemble these objects? I expect you'll see combinations aimed at specific markets—doctors' offices or law firms, for example—and sold through traditional software stores and superstores, as well as through direct mail and trade associations. But I wonder if you'll call up a software vendor directly and order components, or if you'll turn to a value-added reseller or consultant who knows your industry to assemble the tools that are right for you. Soon, perhaps, you'll order your software components the same way you specify the amount of memory, size of hard disk, or type of video system for your PC. The most sophisticated users will be able to combine the components themselves and create applications tailored to their needs. Perhaps companies will have in-house experts to do this for large groups of users. Or perhaps there will be a whole new consulting discipline that helps people customize their computing environment. The possibilities are endless.

GOOD TECHNOLOGY TIMING

Before we get to this brave new world, we have a few obstacles to clear. One of these is the propensity of the big companies to sell "software suites," such as Microsoft Office and Lotus SmartSuite. These can be a good deal for large customers, and they can certainly push companies toward better integration and better consistency. However, the timing is all wrong from a technological viewpoint. We're already seeing a lot more consistency among Windows applications than we ever saw under DOS. (Let's face it, they all use a mouse, pull-down menus, and icons.) We can finally make any set of programs work together. Now is the time for software vendors to work on integration solutions that work with everyone's software, not just their own.

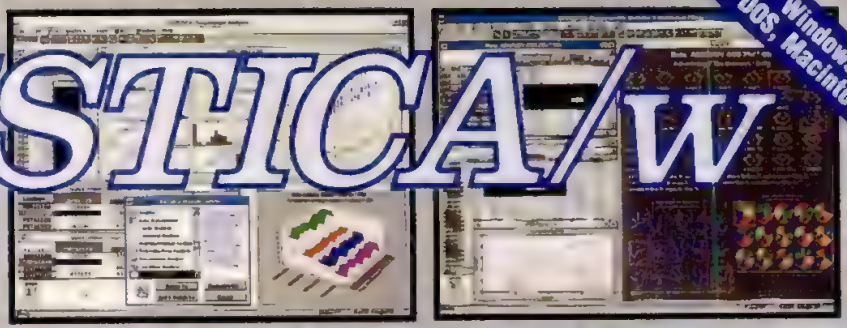
Then there's the matter of standards. Everybody wants their own. Just look at the database access standards. There's Microsoft's ODBC, Borland's IDAPI, and Oracle's Glue all on top of industry standards such as the SQL Access Group. And look at messaging standards: We have Microsoft's Messaging Application Programming Interface (MAPI), Lotus's Vendor Independent Messaging (VIM), Novell's Message Handling Service (MHS). Standards should be open and independent, but it seems we're getting APIs that are an extension of someone's own software!

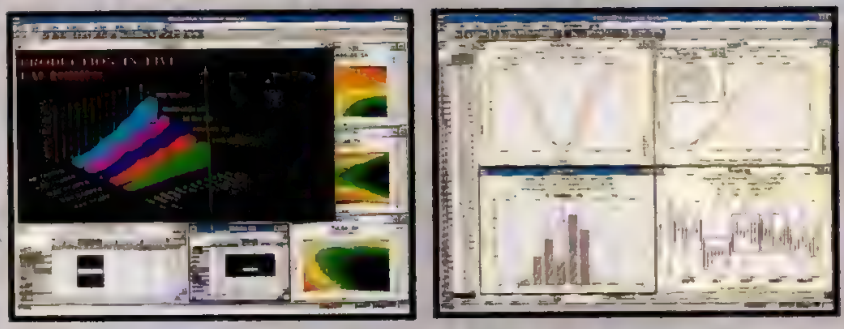
If we want all of this integration, we need to start demanding it from vendors. We need to insist that developers start working with one another's products so that, say, Microsoft Word can work with Quattro Pro files and Lotus Notes can use WordPerfect as an editor. If there are going to be multiple "standards," we need to make sure that these standards communicate with one another. We also need to make sure that the components we buy have open, published interfaces and file formats so that we can tie them together. And, finally, we need to start looking at which companies give lip service to the idea of application integration and which actually implement it. □

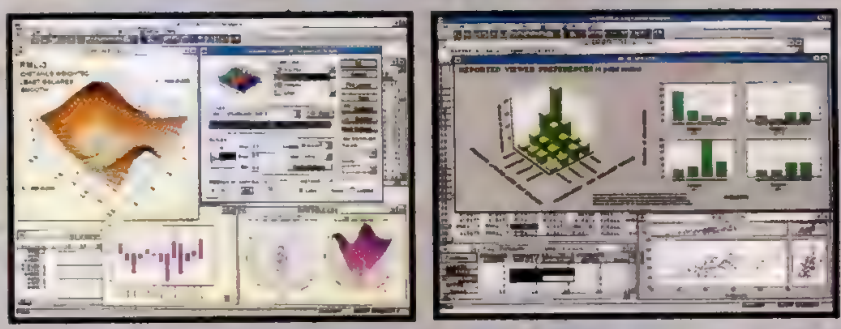
CIRCLE 148 ON READER SERVICE CARD

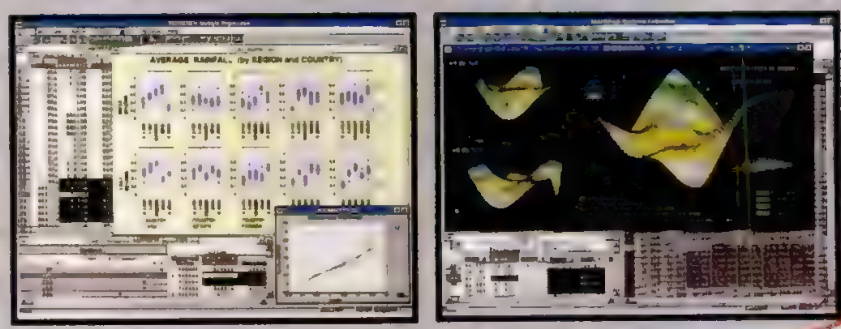
STATISTICA/w

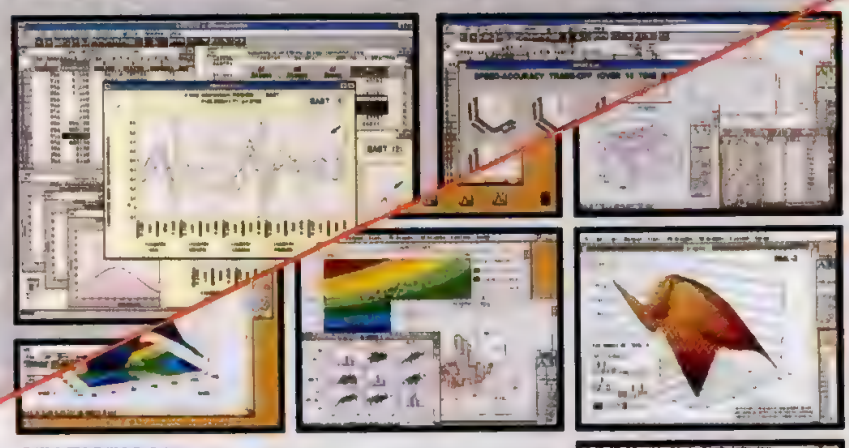
Windows, DOS, Macintosh











STATISTICA/w™ (for Windows) Complete Statistical System with thousands of on-screen customizable, presentation-quality graphs fully integrated with all procedures ■ Complete Windows 3.1 support, DDE, OLE, TT-fonts, multiple toolbars, right mouse button support ■ Unlimited numbers of data-, results-, and graph-windows ■ Inter-window integration: data, results, and graphs can be treated as objects and converted into one another in a number of ways ■ The largest selection of statistics and graphs in a single system; comprehensive implementations of: Exploratory techniques; multiway tables with banners (presentation-quality reports); nonparametrics; distribution fitting; multiple regression; general nonlinear estimation; stepwise logit/probit; general ANCOVA/MANCOVA; stepwise discriminant analysis; log-linear analysis; factor analysis; cluster analysis; multidimensional scaling; canonical correlation; item analysis/reliability; survival analysis; time series modeling; forecasting; lags analysis; quality control; process analysis; experimental design (with Taguchi); and much more ■ Manuals with comprehensive introductions to each procedure and examples ■ Hypertext-based Stats Advisor expert system ■ Extensive data management facilities (spreadsheet with long formulas, block operations, advanced Clipboard support, DDE hot links, relational merge, data verification, powerful programming language) ■ Batch command language and macros also supported, "turn-key system" options ■ All output displayed in Scrollsheets™ (dynamic, customizable, presentation-quality tables with toolbars, pop-up windows, and instant 2D, 3D and multiple graphs) ■ Extremely large analysis designs (e.g., correlation matrices up to 32,000x32,000, unlimited ANOVA designs) ■ Megafile Manager with up to 32,000 variables (8 Mb) per record ■ Unlimited size of files; extended ("quadruple") precision; unmatched speed ■ Exchanges data and graphs with other applications via DDE or an extensive selection of file import/export facilities ■ Hundreds of types of graphs, including categorized multiple 2D and 3D graphs, matrix plots, icons, and unique multivariate (e.g., 4D) graphs ■ Facilities to custom design new graphs and add them permanently to menu ■ On-screen graph customization with advanced drawing tools, interactive stretching and resizing of complex objects, interactive embedding of graphs and artwork, special effects, icons, maps, multi-graphics management, page layout control for slides and printouts; unmatched speed of graph redraw ■ Interactive rotation, perspective and cross-sections of all 3D and 4D graphs ■ Extensive selection of tools for graphical exploration of data: fitting, smoothing, overlaying, spectral planes, projections, layered compressions, marked subsets ■ Price **$995**.

Quick STATISTICA/w™ (for Windows) A comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/w ■ Price **$495**.

STATISTICA/DOS™ (for DOS) A STATISTICA/w-compatible data analysis system ■ Price **$795**.

Quick STATISTICA/DOS™ (for DOS) A subset of STATISTICA/DOS statistics and graphics ■ Price **$295**.

Domestic sh/h $10 per product; 14-day money back guarantee.

CIRCLE 057 ON READER SERVICE CARD

StatSoft™

2325 E. 13th St. • Tulsa, OK 74104 • (918) 583-4149
Fax: (918) 583-4376

Overseas Offices: Statsoft of Europe (Hamburg, FRG), ph. 040/ 4200347, fax 040/4911310 **StatSoft UK** (London, UK), ph 0462/482822, fax 0462/482855 **StatSoft Pacific** (Melbourne, Australia), ph (03) 663 6580 fax (03) 663 6117 **StatSoft Canada-CCO** (Ontario) ph 416-849-0737, fax 416-849-0918 Available From CORPORATE SOFTWARE and other Authorized Representatives Worldwide Holland MAB Julsing, 071-230410, France version US (1) 40590913, Sweden AkademiData 018-240035, Hungary Dagent Kft 186-5782, Belgium: TEXMA 10 61 16 28, South Africa Osiris 12 663-4500, Japan (Macintosh): Three's Company, Inc., 03-3770-7600; Japan (DOS and Windows): Design Technologies, Inc., 03-3687-1110.

STATISTICA/Mac™ (for Macintosh) A STATISTICA/w-compatible, comprehensive data analysis and graphics system designed for the Macintosh ■ Large selection of statistical methods fully integrated with presentation-quality graphics (incl EDA, multiplots, a wide selection of interactively rotatable 3D graphs; MacDraw-style tools) ■ Unlimited size of files ■ Full support for System 7, incl. "Publish and Subscribe" ■ Price **$595**.

Quick STATISTICA/Mac™ (for Macintosh) A subset of STATISTICA/Mac: a comprehensive selection of basic statistics and the full graphics capabilities of STATISTICA/Mac ■ Price **$295**

It's Amazing What NEC

- *30-day money-back guarantee*
- *Toll-free technical support*
- *Free FedEx® shipment within 72 hours*
- *Free one-year on-site service*

Introducing NEC Select Solutions: A lot of extra bang for no extra bucks.

Why settle for an ordinary PC when, for the same price**, you can have an NEC Select Solution™ system? Every NEC Select Solution gives you the quality of an NEC system, the convenience of pre-loaded, optimized Microsoft® Windows™, and the performance of a world-renowned NEC MultiSync® monitor.

NEC SELECT SOLUTIONS

We've made Windows faster and easier than ever.

Through a strategic partnership with Microsoft Corporation, we've developed a method for optimizing Windows 3.1 that actually makes Windows computing not only easier but up to **20% faster** as well.

MICROSOFT® WINDOWS™ READY-TO-RUN

For example, the NEC custom Windows Program Manager (like the one at left) organizes the applications that work together into logical groups. An Information Center group provides quick answers to your questions and includes ReadMe files for your system and your applications.

We also streamline your application parameter files by removing unnecessary drivers and filters. And all NEC Select Solutions include the Visual Basic™ library, allowing you to run any Microsoft Visual Basic program.

Free
3-year limited warranty on PowerMate 425 and 433!*

NEC PowerMate® 425

486SX/25MHz, 4MB RAM, 120MB (19ms) hard drive, 1.44MB floppy drive, integrated 1024x768 controller with 1MB video DRAM, integrated fax/data modem, mouse, mousepad, 101-key keyboard. MS-DOS® 5.0 and Microsoft® Windows™ 3.1 are optimized and factory-loaded. Audio tutorial for Windows and NEC's unique "co-session" support software also come standard.

$1,599 *NEC Super VGA 14" Color Monitor*

$1,924 *NEC MultiSync® 3FGx™ 15" Monitor*

intel inside

*One-year, on-site limited warranty is standard on all desktop PC products; three year limited warranty is for PowerMate 425 and 433 only. Call for complete details on our warranty policy. **Based on an approximation of industry-average system prices and the cost of system set-up. *** On-site service may not be available in certain remote areas. NEC Technologies, Inc. GSA certification number GS00K91AGS5341. NEC® and Powermate® are registered trademarks, and Select Solutions™, FG™, Image™, ImageSync™ and Express™ are trademarks of NEC Corporation and its affiliates. All other product, brand, trade names, registered trademarks, or logos used in this publication are property of the respective trademark owners.

Will Sell You For Nothing

To maximize Windows 3.1 performance, we fine-tune many of its features: FastDisk is enabled; the system swap file is positioned for fastest access; memory interleaving is optimally sized; and your hard drive is fully optimized for maximum performance. It's Windows like you've never seen it before. And it's standard on every NEC Select Solution.

Outstanding performance from NEC monitors and CPUs.

Every one of our NEC Select Solutions includes an NEC MultiSync FG™ color monitor, widely recognized as the industry's best.

Our monitors would be great with any PC, but they perform even better with our PowerMate®, Image™, and Express™ series computers. NEC's unique ImageSync™ feature enables our PCs to adjust the display on a MultiSync monitor so that it operates at the maximum refresh rate. The result is integrated performance you can't get anywhere else, at any price.

Want to network? Just ask us.

Every NEC Select Solution is available with network boards and Novell® drivers installed and configured to get you connected in no time. When you call, we'll be glad to discuss your individual networking requirements.

NEC PowerMate 433

486DX/33 MHz, 4MB RAM, 120MB (19ms) hard drive, 1.44MB floppy drive, integrated 1024x768 controller with 1MB video DRAM, integrated fax/data modem, mouse, mousepad, 101-key keyboard. MS-DOS 5.0 and Microsoft Windows 3.1 are optimized and factory-loaded. Audio tutorial for Windows and NEC's unique "co-session" support software also come standard.

$1,999 *NEC Super VGA 14" Color Monitor*

$2,324 *NEC MultiSync 3FGx 15" Monitor*

NEC PowerMate Express™ DX2/66e

486DX2/66MHz, 8MB RAM (expandable to 256), 240MB hard drive, 1.2 and 1.44 MB floppy drives, 128KB cache, 5 EISA expansion slots, mouse, mousepad, 101-key keyboard. MS-DOS 5.0 and Microsoft Windows 3.1 are optimized and factory-loaded. Audio tutorial for Windows also comes standard.

$3,857 *NEC Super VGA 14" Color Monitor*

$4,179 *NEC MultiSync 3FGx 15" Monitor*

Toll-free ordering, guaranteed satisfaction.

Our toll-free hotline is open from 9 am to 8 pm EST, Monday through Friday. When you order, **we ship within 72 hours**—and we mean it. (All prices include **FedEx® Economy Two-Day℠ Service.**) We also give you a variety of payment options, **a 1-year limited warranty*, a 30-day money-back guarantee, an entire year of free on-site service*****, and plenty of expert, toll-free technical support.

If you like, you can upgrade your Select Solution with an NEC MultiSync 4FG, 5FG, or 6FG monitor, add extra memory, and select from a wide variety of hardware options, storage devices and printers.

NEC Select Solutions are also available with pre-loaded, ready-to-run application software from **Microsoft, Aldus,** and **Autodesk.** We even offer ready-to-work file servers that actually make it easy for you to set up a **Novell** NetWare™ LAN.

Sure, you can buy an ordinary system for the same price—*without* optimized Windows, *without* NEC hardware, and *without* our style of service. But why settle for a compromise when you can have a Select Solution?

1-800-374-8000

TO ORDER DIRECT

NEC

CIRCLE 394 ON READER SERVICE CARD

SFX, LIES AND VIDEOTAPE.

Honest. Whatever you've heard about PC video production being too costly, too complicated and too time-consuming is no longer true.

Now, with new Pro MovieSpectrum,™ making and playing digital motion videos on your PC is simple and affordable!

Your presentations, sales and training materials will come alive. Anywhere you've been using still photos, graphics or diagrams, now you can use full action video clips or on-screen announcers with music or sound effects.

What's more, with Pro MovieSpectrum, you can watch videos from your VCR, camcorder or laser disc right on your PC. You can even save the movies on your hard disk.

Best of all, Pro MovieSpectrum includes everything you need for under $400. Like an add-in video card, Microsoft® Video for Windows® and Macromedia's® Action!™

Kiss hardware limitations goodbye. Plus, use as much system RAM as you want! Pro Movie gives you the freedom to record and playback digital video with virtually any VGA card (no feature connector required), under Windows or DOS.

Macintosh, DOS or Windows. Pro Movie includes Software Players, enabling you to watch movies on Windows or DOS. And with the AVI® to Quicktime® converter, movies you create on your PC can be played back on your Mac.

Control video sources with your keyboard or mouse.

Search and edit video footage on your VCR, camcorder or disc player — directly from a control panel on your screen.

S-Video, editing and more. Input video from NTSC composite all the way to the higher quality S-video format. Control hue, saturation, contrast and brightness with resolution of 32,768 colors. And since Pro MovieSpectrum is AVI™ compatible, you can capture, edit and playback your movies with Microsoft's Video for Windows.

So get Pro MovieSpectrum — the premier package that gives your PC major motion picture capabilities — at a very affordable ticket price. And that's no lie.

MEDIA VISION

Call **1-800-854-5870** for a dealer near you. ©1992, Media Vision, Inc., 3185 Laurelview Court, Fremont, CA 94538
Pro MovieSpectrum is a trademark of Media Vision, Inc. All other trademarks and registered trademarks are of their respective holders.

CIRCLE 093 ON READER SERVICE CARD

Bill Machrone

Finally: A Reason for Multimedia

I'm sitting here at 37,000 feet, and the guy next to me with the IBM 700C has just figured out that my headphones are plugged into my Gateway laptop. He knows I'm listening to something, and he's craning his neck so badly to see my screen that he's going to need a chiropractor by the time we get to San Francisco. He's trying to be subtle, and he's about as sly as a submarine in a bathtub. Now he's a little dismayed by the odd noises I'm uttering under my breath. For his next move, he makes an unnecessary trip to the rear of the cabin so he can have a clearer view of my screen on the way back.

What he sees is Power Japanese, a Windows-based instructional tour de force in speaking, reading, and writing Japanese. To my amazement, I'm actually making progress. I'm learning the sounds and the written forms at the same time in easy, digestible pieces. This is way better than any cassette-based course could possibly be. A tiny adapter, furnished with the course, plugs into the computer's parallel port. It has a socket for headphones (which is also included) or speakers. Power Japanese comes on 14 disks, many megabytes of which are digital sound files. The sounds give me something to imitate, providing far more helpful aid than the usual phonetic pronunciations that are printed in the guidebooks. I can hear sounds repeated with a click of the mouse without having to rewind a tape.

MIND-STRETCHERS

I'm less than halfway through the course now, and I'm getting a severe case of brain stretch. The program's Learner's Dictionary has a concise guide to Japanese grammar and form, which are substantially different from English grammar and form. It approaches the differences from the societal level as well as the grammatical, so it gives insight into the Japanese character, not just the character set. You learn why sentences are constructed the way they are and the importance of the speaker's relationship to the subject and to the listener.

The course is divided into four parts: *hiragana* (the phonetic symbols used for native Japanese), *katakana* (the phonetics of foreign words), and two grammar and vocabulary sections. Together, they take up more than 20MB of disk space, but the installation program lets you load and unload modules.

Power Japanese draws and pronounces characters simultaneously, a method of writing instruction that is infinitely superior to the little numbers and arrows in printed texts. You get to see the order and direction of the strokes, which makes them much easier to imitate. Only a human teacher could be better, and even then, he or she would need the computer's infinite patience.

Power Japanese comes with practice books for writing. It accustoms you to writing from the top down and from right to left, although the exercise books caution you that you'll also see Japanese written from left to right. In any event, writing Japanese is a strange experience. At first, it feels like you're laboriously copying meaningless symbols. With repetition, though, the sounds and the shapes begin to make sense.

I'm learning Japanese (I really think so)! Why is Power Japanese the Fourth Multimedia Application?

Nothing is ever simple, of course, and I had a lot of trouble with the drill screens because Laptop UltraVision was remapping some of the colors so that the screens were unreadable. I'm so used to UltraVision's marvelously readable text fonts that I can't imagine using a laptop without it. Because the program lives in the background, I only slowly came to suspect problems. Once I selected a new palette, though, everything was fine.

BREAKING NEW GROUND

Until now, there were only three multimedia applica-

Illustration by Nishan Akgulian

Hassle-Free Printer Sharing

Give everyone in your office their own HP LaserJet printer...without buying another one

Any Office Any Budget Any Printer

Advanced printer-sharing technology. Our ***ServerJet*** products give up to 12 users a direct line to the printer. ***ServerJet*** also lets users switch back and forth between two printers – without leaving their chairs. People won't be lined up, disks in hand, waiting to use the PC connected to the printer. Each user can simultaneously send *their* print job, *their* way, thanks to ***ServerJet*** buffer memory (up to 4MB).

Effortless Installation

Just plug the ***ServerJet*** into the printer.

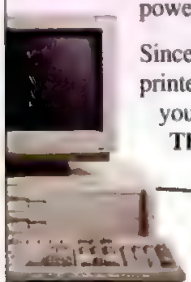
Run telephone-type cable to any desk, anywhere. And once your ***ServerJet*** system is up and running, its lightning speed (up to 115.2*Kb*) will save you time and money all around.

Easiest Installation, Fastest Performance On A Novell Network

Many users have installed our product in five minutes. We can turn your LaserJet into a stand-alone print server – one that gets jobs to the printer 3 to 5 times *faster* than Novell's Print Server utility. And you can connect the printer anywhere on the network.

Printer Sharing For The New HP *LaserJet 4*

We keep pace with printer technology. That's why we worked closely with HP to have *seven* advanced printer-sharing devices ready for their powerful new LaserJet 4.



Since 1987, people have relied on ASP for cost-effective, *hassle-free* printer-sharing. And because we stand behind our product, we offer you a 30 day trial with our ***ServerJet*** – no risk, no obligation.

The call is free. The trial is free.

US and Canada

800-445-6190

DEPT 33155

ASP

ASP COMPUTER PRODUCTS, INC.

160 San Gabriel Drive, Sunnyvale, CA 94086, USA
Telephone: 408-746-2965 • Facsimile: 408-746-2803
Int'l Phone (33-1) 41-07-91-70 Fax: (33-1) 41-07-91-79

yes NetWare Tested and Approved

ServerJet is a trademark of ASP Computer Products, Inc. / HP LaserJet is a registered trademark of Hewlett-Packard Co. / Novell is a registered trademark of Novell Corp

CIRCLE 008 ON READER SERVICE CARD

Bill Machrone

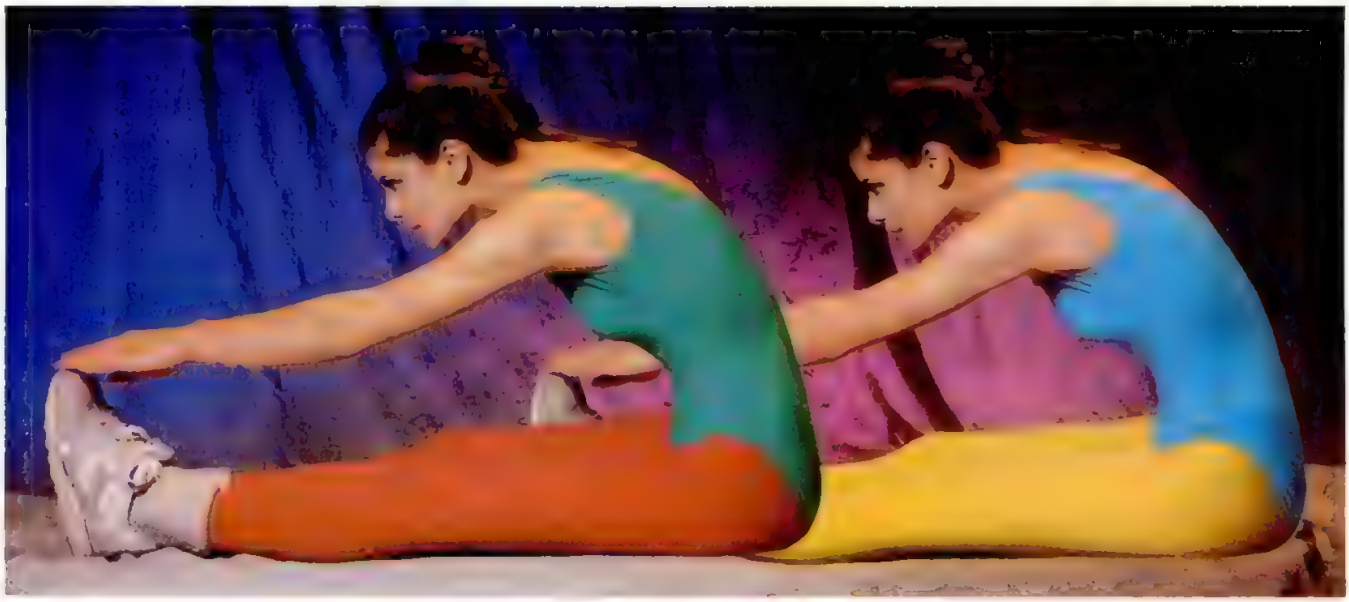
tions. Never mind how many products call themselves multimedia, three is the number. Power Japanese is the Fourth Multimedia Application.

The First Multimedia Application is the sound-and-pictures database. It doesn't matter whether the pictures are moving or not. The Second Multimedia Application is the annotated anything—spreadsheet, voice/data mail, or text document. The Third Multimedia Application is the game—of any sort. The animation, interaction, and synchronization of games make them a breed apart. Language instruction is unlike all the others because it requires navigation through a complex maze of basic information, interactive instruction, drills, and exercises. Instruction in Japanese is significantly different from instruction in other languages because of the graphical nature of the written language.

The only thing that could make Power Japanese better is compatibility with a pen-based computer. I would love for it to read my scratchings as I draw the Japanese characters and for it to pronounce them for me when I get them right. I could then trace over the machine's drawing of the characters rather than copying them from screen to paper. A pen-based machine could also show me my errors on a pixel-by-pixel basis.

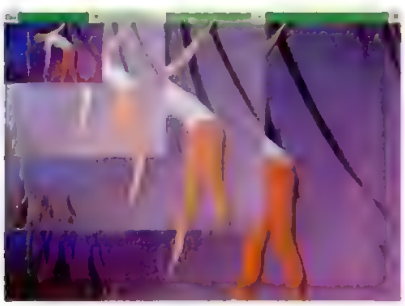
The publisher of Power Japanese, BayWare (415-312-0980), has another product, called Kanji Moments. If you're going to read Japanese publications, you need to master *kanji* (the ideographic character set). The characters number in the thousands, and Kanji Moments presents a couple of hundred to work through in each group, or "moment." Using many of the same techniques used by Power Japanese, it takes you through simple articles. When you click on a word or sentence, the program will pronounce or translate it. The only thing I thought was unrealistic about Kanji Moments was the writing drill, where you use the mouse to draw the Kanji characters. Mousing is so unlike writing that the skill is barely transferable to pencil and paper. Where's that pen-based computer when we need it?

Power Japanese and Kanji Moments are much more than useful multimedia applications. You find yourself learning not only what to say, but why you're saying it that way. They're a breakthrough in learning a forbiddingly complex language. □



Exercise Your Video... Stretch It!

Why settle for an out-of-shape graphics board? Let ATI's new GRAPHICS ULTRA+ and GRAPHICS ULTRA PRO cards pump up your computer with graphics and multimedia video acceleration.

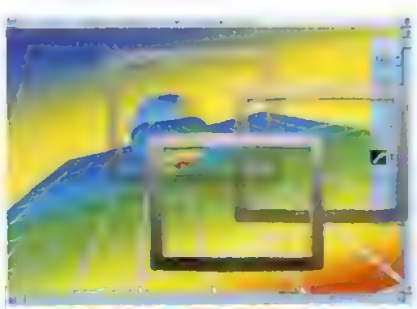


Only the GRAPHICS ULTRA+/PRO cards come ready to accelerate[1] multimedia applications under Windows. Stretch small video images to partial or full screen for better visibility... and maintain smooth dynamic motion (when others fall behind).

ATI's *mach32* Accelerator Chip adds the muscle to run Windows, NT, OS/2 and CAD fast... even faster than other local bus solutions. With 2.0MB of video memory, ATI accelerates 1024x768 in 65,000 colors. Run resolutions up to 1280x1024, colors up to 24-bit, and sit-up to flicker-free graphics at 76Hz refresh rate. Plus, the best software support of ANY accelerator product with ATI, VGA, VESA or 8514/A drivers.

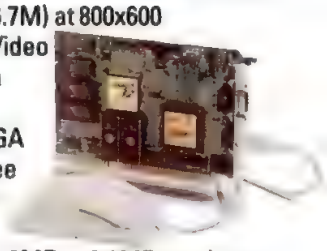
accelerated by mach32 ATI TECHNOLOGIES INC

Exercise your options under Windows with the FlexDesk Control Panel or use DeskScan to pan and zoom across a virtual desktop. And our exclusive CRYSTAL FONTS smooths TrueType for laser-quality text right on-screen.



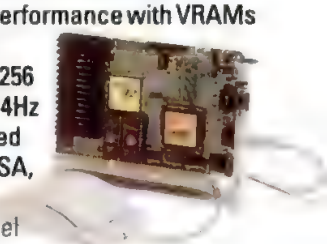
GRAPHICS ULTRA+

- Accelerated 1024x768 at 65,000 colors
- True color (16.7M) at 800x600
- Multimedia Video Acceleration
- Fast zero wait-state VGA
- Includes three button inport mouse[2]
- Available in 1.0MB or 2.0MB versions
- 5 year warranty
- Priced from $399.00[3]



GRAPHICS ULTRA PRO adds

- Even faster performance with VRAMs
- Accelerated 1280x1024 at 256 colors up to 74Hz non-interlaced
- Available in ISA, EISA and Micro Channel versions
- Priced from $599.00[3]



Avoid low impact graphics. Shape up with ATI Graphics and Multimedia Video Accelerators.

ACCELERATORS · GRAPHICS · MULTIMEDIA · COMMUNICATIONS

MICROSOFT WINDOWS COMPATIBLE · PC MAGAZINE EDITORS' CHOICE · COMPUTER SHOPPER · MVP WINNER · indeo INTEL VIDEO TECHNOLOGY

ATI TECHNOLOGIES INC.
Perfecting the PC

ATI TECHNOLOGIES INC.
3761 Victoria Park Avenue
Scarborough, Ontario
Canada M1W 3S2
Tel: (416) 756-0718
Fax: (416) 756-0720

Copyright © ATI Technologies Inc., 1993. All company and/or product names are trademarks and/or registered trademarks of their respective manufacturers. [1]Accelerates Indeo Video, RLE and Video 1 compressed files under Video for Windows. QuickTime for Windows support is planned. Performance varies depending on system configuration. [2]ISA versions only. [3]Suggested retail prices, dealers may sell for less. Prices and features are subject to change without notice.

CIRCLE 228 ON READER SERVICE CARD

"HYUNDAI'S LOCAL
THE COMPETITI
(AND OUR PRICES

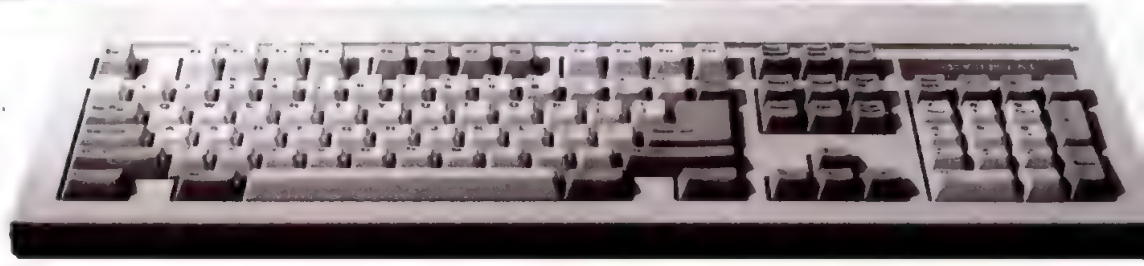
"Hyundai's new machines are a great example [of value]...the upper end units such as the 433SP..., with fast disks, fast caches, and *very* fast local-bus video, knock competitors' machines for a loop."

Jim Seymour
PC Magazine
February 9, 1993

$1849

Hyundai 425SP
25MHz i486SX

- ★ 25MHz i486 with 8KB cache
- ★ 32-bit local bus graphics/1MB Video DRAM
- ★ 128KB 20ns level 2 cache
- ★ 170MB HDD (17ms)
- ★ 4MB RAM
- Upgradable to 486DX2
- Dual floppy drives
- UltraVGA 1024 NI Monitor (14", .28mm, 1024x768)
- MS DOS 5.0, MS Windows 3.1, Mouse
- 12-month on-site service
- 18-month parts & labor warranty



Shown with optional CD ROM drive

Hyundai 433SP
4MB/170MB (17ms) HDD
33MHz i486SX CPU
$1949

Hyundai 433DP
4MB/250MB (14ms) HDD
33MHz i486DX CPU
$2299

Hyundai 450D2P
4MB/250MB (14ms) HDD
50MHz i486DX2 CPU
$2549

FREE FAX & SW WITH DESKTOP SYSTEMS

- **FREE** PFS WindowWorks
- **FREE** FAX/Modem w/Phoenix Fax for Windows
- **FREE** CompuServe Trial Subscription

BUS 486's KNOCK ON FOR A LOOP." KNOCK 'EM COLD.)

FREE Lotus Organizer

EDITORS' Home Office COMPUTING PICK January 1993

$2699

Hyundai 486SLC Spectra Color Notebook

- ★ **25 MHz 486SLC**
- ★ **Color VGA 640x480**
- ★ **Built-in trackball**
- ★ **4MB RAM standard, expandable to 8MB**
- ★ **120MB Hard Drive**
- ★ **Built-in FAX and Data Modem**
- 9" color LCD
- DOS 5.0, Windows 3.1, WinFax preloaded
- 12-month on-site service
- 18-months parts & labor warranty

DO SOMETHING NEW BREED

Just when you thought you had your short list made, WHACK! Hyundai's 486 PCs score a knock-out. The leading computer magazines are giving our PCs superior scores for performance and value. And best of all, these screaming 486 machines are ready for immediate shipment! So call Hyundai, the company that's here for the long haul, and get performance and value backed by round-the-clock service and support, seven-days-a-week.

24 HRS. 7 DAYS.

Hyundai Courier Notebook

25MHz 386SXL
2MB RAM, exandable to 8MB
80MB Hard Drive
PCMCIA Expansion Slot
Built-in trackball
VGA 640x480 10" LCD
DOS 5.0 and Windows 3.1

$1549

FREE Lotus Organizer

Tech Support 800-289-4986
Tech Fax 800-283-4986
Tech BBS 800-955-5432

HYUNDAI
PCs designed and built in America

Hours: 6AM-5PM PST M-F
166 Baypointe Pkwy.
San Jose, CA 95134

800-933-3445

PCM 122

We accept MasterCard, Visa, money orders, certified checks (allow 10 days for processing), CODs, approved company and institutional purchase orders, and wire transfers. All return items must be accompanied by a return merchandise authorization (RMA) number. Opened, defect-free software is non-refundable. Prices and product descriptions are subject to change without notice. Hyundai is not liable for damage due to omissions or typographical errors. All trademarks are the property of their respective companies. The Do Something logo is a trademark and Do Something New Breed is a registered trademark of Hyundai. © 1993 Hyundai Electronics America. All rights reserved.

CIRCLE 275 ON READER SERVICE CARD

"A wonder of small-scale engineering"
–*PC Week*
September 14, 1992

"The first mini PC with a keyboard large enough for serious typing"
–*PC World*
November 1992

"Blows the HP palmtop away"
–*Computer Shopper*
December 1992

ONLY $595!

- *CPU:* Industry-standard NEC V30.
- *Memory:* 1 MB of RAM and 1.5MB of ROM.
- *Size:* Only 1.3 lbs., 9⅝" x 4½" x ⅞".
- *Power Supply:* Two AA alkaline batteries and 2032 Lithium back-up battery, all included. Ten hours battery life with continuous use, even more in suspend!
- *Preloaded Software:* MS-DOS 5.0 system files, Microsoft Works 2.0 (word processing, spreadsheet, database and communications programs) and a personal organizer, planner, to do list, card file, information retrieval and calculator.
- *I/O Ports:* One serial, one parallel and two PCMCIA memory card connectors.
- Carrying case, cables and adapters included.
- *Power Management:* Automatic transition between active, doze and suspend modes.
- *Screen:* Easy-to-read 7" x 2¾", 640 x 200, 80 x 25 character display.
- *Keyboard:* 81-key with 12 function keys, embedded numeric keypad and special-function hot keys.
- *Special Travel Kit only $249!* Comes with send/receive fax/modem and communications software.

ORDER NOW TOLL FREE:
800-554-7172

Fax Orders: 612-633-1325
Government: 800-245-2449
Outside U.S. and Canada: 612-633-6131
Hearing Impaired (TDD): 800-228-5389
MasterCard, VISA, Discover, American Express, Z-Card, COD and Leasing Programs
Open 24 Hours a Day, 365 Days a Year!

All prices and specifications are subject to change without notice. Please call for current pricing and warranty details. ZEOS is a publicly traded company; NASDAQ symbol: ZEOS. © 1993 ZEOS International, Ltd., 1301 Industrial Blvd., Minneapolis, MN 55413 USA. All products and company names are trademarks or registered trademarks of their respective holders. PT1L-PCM-93038

ZEOS

The World At Your Fingertips.

INTRODUCING A 1.3 LB. PC! SEND & RECEIVE E-MAIL AND MORE.

Imagine a portable PC that lets you send and receive e-mail, modem a memo to the home office, write reports, create spreadsheets, manage your calendar, calculate your expenses...*work non-stop for ten hours*...and is so portable that it weighs about the same as a notepad.

A futuristic fantasy? Not unless the future is now. It's the ZEOS® Pocket PC, and only ZEOS has it. You're going to love how portable and affordable it is. In fact, we think you'll find it's the one PC you'll want to take with you everywhere!

COMPACT YET COMPLETE.

At only 9⅝" x 4½" and only 1.3 lbs., what's great about the ZEOS Pocket PC is that it has a keyboard you can really use. If you're accustomed to typing with both hands, switching to a palmtop can be awkward because the keyboard only lets you type with one hand or even one finger. Yet the ZEOS Pocket PC's keyboard lets you use both hands easily, so you won't sacrifice comfort and speed for portability.

And even though it's small, the ZEOS Pocket PC carries a *full suite of industry standard software* already loaded and ready to go! You get Microsoft DOS 5.0 system files with built-in file transfer and Microsoft Works 2.0 with word processing, spreadsheet, database and communications programs. Plus, you get a personal organizer which includes a calendar/planner, "to do" list, business card file, information retrieval (for country codes, converting measurements and currency) and more. It's everything you need to manage your life!

YOUR LINK TO THE WORLD.

Modem a memo to a client; send and retrieve your e-mail. With the Pocket PC's optional fax/modem, you can communicate worldwide. Plus, expanding the memory is another easy option—with an additional memory card that slips right into a slot on the system's underside. And that's not all.

IT JUST KEEPS GOING...

Ten hours of continuous use? Absolutely! All it takes is the two AA alkaline batteries included with your system. And your ZEOS Pocket PC has great power management, too—it automatically switches to the suspend mode when you take a break. Plus, when you turn off your system, then turn it on again, it goes right back to where you left off. What a time-saver!

FREE 24-HOUR TECH SUPPORT.

Questions about your purchase? ZEOS technical support is 24 hours a day, 365 days a year, and always toll-free. And we back every ZEOS purchase with our 30-Day Absolute Satisfaction Money-Back Guarantee, One Year Limited Warranty and more.

ORDER YOUR ZEOS POCKET PC TODAY. MAKES A GREAT GIFT!

Call us today at 800-554-7172. You're going to love the new ZEOS Pocket PC. *We guarantee it!*

SERVICE • RELIABILITY • PC MAGAZINE • READERS' CHOICE

BUY WITH CONFIDENCE.
ZEOS just won PC Magazine's *Readers' Choice for Service & Reliability (Feb. 9, 1993). We're the only PC vendor to earn the "Excellent" rating for both our laptop* and *desktop systems!*

CIRCLE 125 ON READER SERVICE CARD

John C. Dvorak

The PC Zombie Haunts the Future

The PC architecture is dying. Microsoft knows this. IBM knows this. The cloners who are struggling know this. The cloners who are making money know this. The readers of *PC Magazine* know this. Everybody seems to know this except the accountants at Intel, who see huge profits from sales of the 486 into this dead-end architecture. The joke will be on Intel if it doesn't wake up and move us to a new design.

It's the crummy AT BIOS that is killing the PC. Microsoft is already banking on moving to RISC chips, including the MIPS processors and the DEC Alpha chip. IBM is looking at microkernel technology for OS/2 for eventual porting to a new platform. If that doesn't work, it has its own Power PC chip. It's also working on a new operating system/environment with Apple and is working with Unix. Is this a company hedging its bets or what? If the future of the Intel architecture was secure there wouldn't be all this non-Intel-oriented activity.

The PC AT—a decade-old design upon which all clones are modeled—is barely viable nowadays. Modern users shouldn't be concerned about incompatible drivers, IRQs, flaky subsystems, and all the rest of the PC nightmare. Smart money avoids these hassles and buys a Macintosh. Even with OS/2 and NT, which supposedly standardize SCSI, there's nothing like the Mac for SCSI ease. I never did get SCSI to work on my OS/2 system, and I'm not going to spend the rest of my life trying. The problem isn't with SCSI or with OS/2. It's with the machine's BIOS.

Subsystems have changed a lot in a decade, but the BIOS hasn't changed a bit. That IBM and Microsoft can get OS/2 and Windows to work on these machines at all is something of a miracle.

I've pestered Microsoft to develop a new PC BIOS and set a new direction. There is no evidence that Microsoft even cares. It made its intentions clear by making Windows NT run on every imaginable non-PC platform. Microsoft sees a bigger market to dominate if things fragment.

IBM simply doesn't get it. It dropped the ball when it went proprietary with the PS/2. After that, the company lost its way. Only the totally new (non-Intel) Power PC platform has a chance of great success, but the IBM bureaucracy has already hampered its promotion in favor of the AS400 diehards. All observers see IBM as preoccupied with its installed base of old-style computers. Maybe all of the IBM reorganizations will help. But it's unlikely they'll help Intel!

You can also forget about Compaq, Dell, and Gateway. They're mostly equals who growl at each other and offer no industry-wide leadership.

There is only one company that can save the Intel family line: Intel itself. Intel makes chips. Intel designs systems. Intel even makes clones—lots of them. Intel has the most to lose in a platform change. Intel has to be the one to design and sell BIOS/2 or whatever. It should immediately go out and buy AMI and MR.BIOS and a couple of other BIOS designers, put them in a room for a month, and have them design an all-new Intel-based PC.

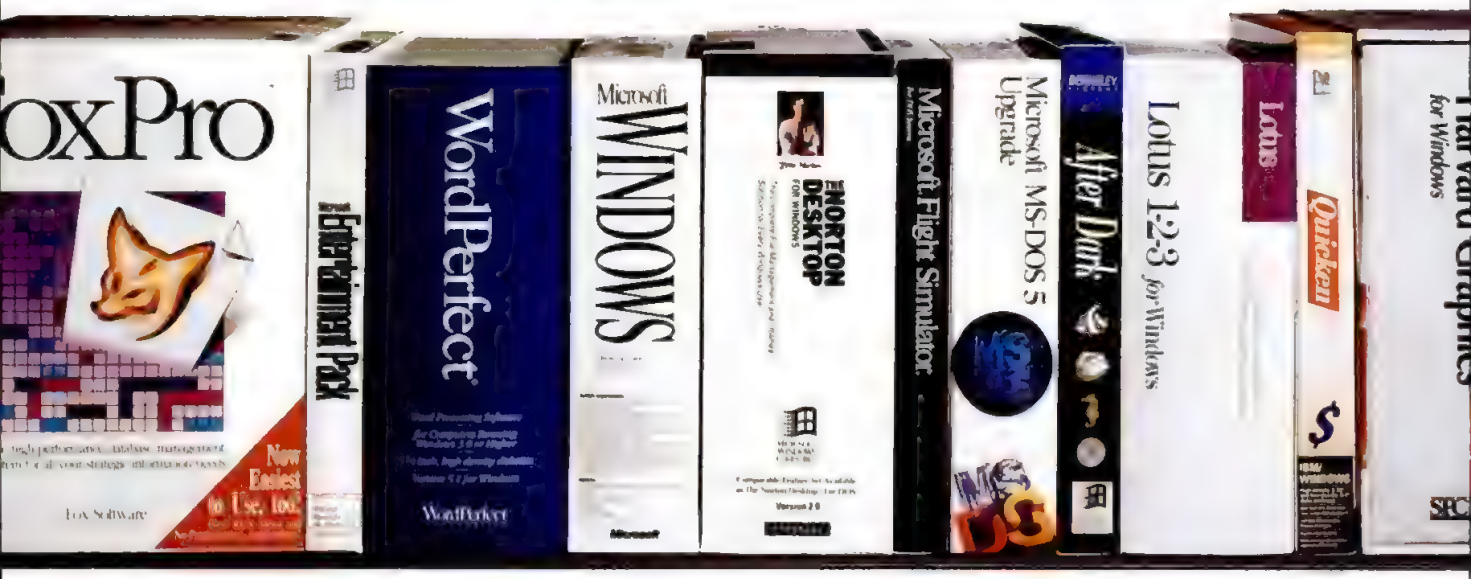
Only Intel has the power to lose the PC's flaky design and save the whole architecture from the trash heap.

Such a machine should be moderately backward-compatible so people can run their old DOS-based programs. More importantly, it should incorporate the latest advances in hardware, such as SCSI-2, memory management, IDE, local-bus video, and even 16-bit stereo sound.

Only Intel has the muscle to develop this new BIOS and assure the viability of the giant market for Intel chips. It will save the PC architecture from the trash heap toward which it's headed.

Illustration by Nishan Akgulian

Once you have all these boxes,



you need this box to store them in.

SEAGATE'S 106 MB ST3120

Have you noticed how today's top-selling software programs are taking up more and more of your precious hard disc capacity? Why, just the applications shown above can eat up over 60 megabytes of valuable storage space before you've even created your first document.

With space-hungry programs like these, even 80 megabyte drives can limit your storage capabilities. But Seagate's ST3120 is just the ticket. It packs 106 MB into a 3.5" low-profile package, with a 15 msec access time and an AT interface. And it does so at a superior cost-per-megabyte rate compared to other drives. So you not only get all the storage and performance you'll need, but you get a great value, too.

So don't let the size of your hard drive restrict your software collection. Check out the ST3120 at your Authorized Seagate Distributor. For complete product information, call Seagate at 408-438-6550.

Seagate

Seagate, the Seagate logo and the Storage by Seagate logo are registered trademarks of Seagate Technology, Inc. All other names and logos are registered trademarks of their respective companies, and are used with permission. ©1992 Seagate Technology, Inc.

John C. Dvorak

Inside Track

Pentium, Pentium, who's got the Pentium? While everyone eagerly awaits the shipment of the Intel Pentium chip, Intel itself is contemplating marketing strategy. It has decisions to make because, according to industry mavens, the **full-blown** 66-MHz version can't be operated with enough leeway on the up side, and the Pentium (a.k.a. the 586) may have to be redesigned so it's somewhat smaller than its current large die size. Smaller is cooler. (Currently, it's about the **size of a small brick**).

According to sources, Texas Instruments has secretly designed a 586 chip that may sneak up on Intel. TI may have used Cyrix as a shield to see what was needed to clone Intel's chips legally.

These chips have to operate above their specified speed to be commercially acceptable. About 72–73 MHz would be needed. If this **isn't achieved** soon, then Intel has a few hard decisions to make. Now, **as a disclaimer,** if Intel is shipping (in quantity) the 66-MHz Pentium by the time you read this, then all is well. If, by the time you read this, the chip *still* isn't shipping in quantities, then it has some problems.

The company can ship the current revision of the chip as a **50-MHz chip** and make some noise about ramping up to 66 MHz. Apparently, the chip works fine at the slower speed. But Intel has the **99-MHz clock-tripled 486 DX3** in the loop and would have to **swallow its pride,** since it's quite likely that the DX3 would outperform the slowed-down Pentium. Decisions, decisions.

The joke of it is that lurking in the background is the **first 586 clone** that might sneak up on the market. According to sources, Texas Instruments has **secretly designed** a 586 chip it hopes to roll out this year. This explains why TI has been closely allied with Cyrix in the **lawsuits** between Intel and Cyrix. In fact, it may have been using Cyrix as a shield to see what was needed to clone Intel's microprocessors legally. Remember that Texas Instruments has a pocket full of basic **semiconductor patents** to trade, so it has a lot of leverage in the industry, too. Also, TI has the design talent to leapfrog Intel. It's designed microprocessors before and has the cash to finance such a venture. With Intel becoming the **number one** semiconductor maker in the world a few months ago, the other companies are finally getting the message: Microprocessors for the mass market are where the action is. Duh!!

Genuinely Interesting Hardware Dept.: Mirroring software seems to be the rage. The idea is that your system has **two sets of hard disks** going at the same time in the form of a RAID or some other array. If one side fails, you just keep going with the **mirrored backup.** Until now, any elaborate mirroring could only be done with expensive SCSI systems. And the software wasn't cheap. No longer. Silicon Valley Computers in Mountain View, California (415-967-1100) has designed an **IDE mirroring disk controller** (dubbed the Mirror Board) that allows you to mirror two sets of two IDE drives plus run four floppies off the controller as a bonus. The card works with every known IDE drive on the market, including the new **two-gigabyte monsters.** Theoretically, you can have, say, four gigabytes in the foreground and four gigabytes being mirrored. Seems adequate to me! No wonder the mainframe is dying. Anyway, the card is a **steal** at $195 and should be considered by anyone looking for an inexpensive IDE solution to this mirroring trend. This is a very cool product.

While on the subject of cool. The mirroring trend is part of a big drift toward **nonstop network servers.** Who needs a breakdown of the main machine in a server environment? That's also the thinking of the premier power-supply maker, PC Power & Cooling. It has developed an **elaborate** backup power-supply system for this same trend. While nothing can be as disastrous as a failed gigabyte hard disk, if the machine won't run because of a failed power supply you might be down for a day while you dig up a substitute. PC Power & Cooling in Carlsbad, California (619-931-5700) has a twin power dual 450-watt special power supply that it sells for $995. It **pumps out 900 watts** by using two 450 supplies in parallel. If one goes out, the other keeps the system up. Cool too!

Genuinely Interesting Software Dept.: If you're a DOS user with an HP laser printer and a word processor, you seldom have a **painless** way to print an envelope based on the address used in the letter you're writing. A new software utility, AddressMate, will do it automatically, without fail! A TSR looks at your document, determines the address, then **triggers the laser printer** to print a perfect envelope. Code is tight, and the system only uses 40K of memory. As a bonus, it prints PostNet bar codes to **speed** mail processing. AddressMate Software is offering this **nifty** utility for $49.95 plus $5 shipping/handling. The price is normally $69.95. Call them at 510-237-7460 for a copy. *Seamless* is the word I'd use here. □

We're putting i486™ technol

intel inside

Now that we've introduced our i486™ SL processor to the world of mobile computing, you'll never look at notebooks the same. That's because, for the first time, you can have the performance of a true 32-bit i486 DX chip to go, with added features to help you garner maximum power from your mobile computer.

One unique feature, our Intel SL technology, actually conserves precious battery life by routing power only to where it's needed. Battery life is further extended through the i486 SL processor's low 3.3-volt operation—which gives you up to an extra hour of computing. Plus, a unique power management feature retains data and instructions even when power is off.

©1993 Intel Corporation. All products are trademarks of their respective companies. i486 SL microprocessors in this ad are larger than actual size.

ogy in a whole new light.

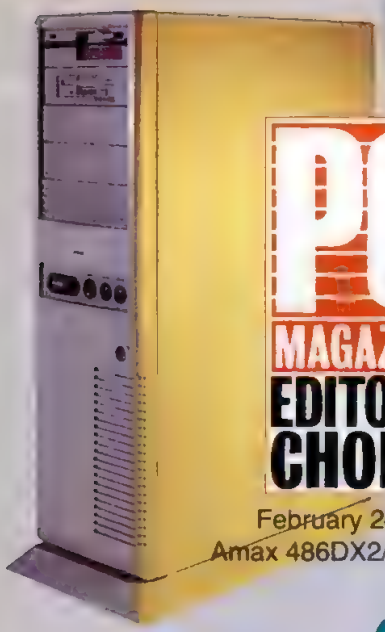
Perhaps more important, however, is the fact that the i486 SL processor is just the latest step in Intel's long-term strategy to provide mobile computer users with uncompromised desktop performance. Together with our ExCA™ cards such as faxmodems and LAN adapters, Intel's mobile processors will give your notebook more versatility. It's no surprise that leading notebook manufacturers are putting Intel SL technology in the spotlight.

To learn more about the new i486 SL processor, call us at 1-800-228-4549, and let us shed some light on the latest in mobile computing.

intel.

CIRCLE 363 ON READER SERVICE CARD

AMAX 486DX2/50 ISAmax Power Station



PC MAGAZINE EDITORS' CHOICE

February 23, 1993
Amax 486DX2/50 ISAmax

"...Olympic-class performance scores on PC Magazine Labs' benchmark tests, spacious expansion possibilities, and excellent components, the AMAX 486DX2/50 deserves a gold medal."

32-BIT VESA LOCAL BUS

32 BIT VIDEO PERFORMANCE

Winmark speeds from 18.5 to over 28 million. Complete line of video cards installed; Diamond, ATI, Orchid, Impression.

UPGRADABLE CPU PERFORMANCE

The Impression 786 Motherboard allows you to upgrade the system performance as simply as changing the CPU. Compatible with 386DX to 486DX2/66MHz processors.

AMAX's VL-BUS PERFORMANCE

AMAX is setting the new standard in Local Bus performance with the NEW 786 ACIO Motherboard from Impression.

Local Bus Power Station Configuration

4MB RAM
Impression 786 Motherboard
256K External Cache
Diamond VL-BUS VGA
Mini Station Case
UL/CSA Power Supply
2 Serial, 1 Parallel
VL- Bus IDE Controller
251MB Hard Drive
1.44 & 1.2 Teac Drive
14" SVGA Impression Monitor
Enhanced 101 Keyboard
Microsoft Windows & DOS

486DX 33MHz
$1879

486DX/2 50MHz
$2125

486DX/2 66MHz
$2279

Notebook 486DX 33MHz
$2195

AMAX Engineering Corporation
3288 Laurelview Court
Fremont, CA 94538

Call Today 800-800-6328 Ext. 68

intel inside

Corporate & Dealer/VAR Inquiries Welcome

All other products are trademarks of their respective holders. Prices and specifications are subject to change without notice. The intel inside Logo is a trademark of intel Corporation
CIRCLE 194 ON READER SERVICE CARD

Jim Seymour

Novell and Unix: A Good Fit

Okay, Unixoids, get ready. Time to *troff* me another nasty note. Because I still just don't get it. Or so you've been telling me for more than 10 years in letters that have also explained exactly why and how Unix was going to take over the computer business and become the dominant desktop operating system within another year or two.

On the other hand, maybe you should read a little further. Though I'm still far from convinced Unix is going to take over much of anything, we may be moving a little closer together in our views of the future of the world's most enigmatic operating system.

Santa brought the Unix marketplace an unexpected present last Christmas: AT&T decided to sell Unix Systems Labs, the company it had spun out to focus exclusively on standardizing and promoting Unix, to Novell. The NetWare gang agreed to pony up $350 million for USL, proving once again that the value of something may be much higher for Buyer A than for Buyer B.

While Roel Pieper, head of USL, had been loudly denying throughout 1992 that the company was for sale, talks had been quietly going on. But no one else was ready to put nearly as much cash on the line. Other potential suitors saw a product line in USL, but for Novell it was a strategic acquisition, as well.

This was not, you should understand, a marriage made in heaven. Rather, it was a marriage made in dark alleys, dark corner booths in smoky bars, and other places where we confront the fears lurking in the darkest corners of our souls.

Novell was, and still is, very worried about Microsoft's Windows NT rollout this year. Microsoft has made clear its willingness to do whatever it takes to own the networking business by virtually giving away peer-to-peer networking in Windows for Workgroups. Now comes Windows NT, a vast and sophisticated operating system capable of making network managers forget every bad joke they ever heard, and repeated, about Microsoft's first versions of LAN Manager. Microsoft is, shall we say, very *serious* about this networking business.

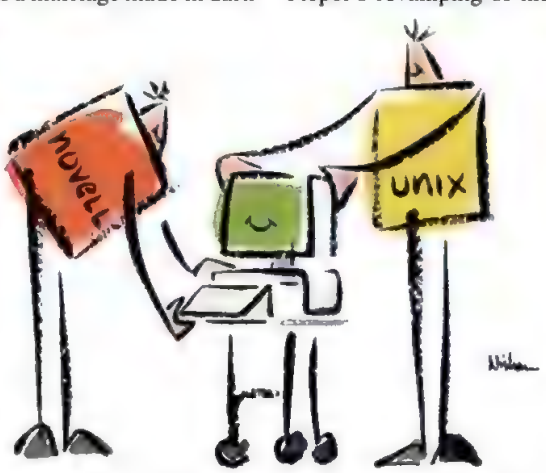
As strong as Novell is, with a 65 percent share of the network operating system market, it has reason to be worried: The Microsoft juggernaut won't wipe out everything in its path, but no matter how Novell responds, NetWare will lose some market share.

So strategically, the USL play may help arm Novell for its coming big battle with Microsoft and Windows NT by helping Novell get to market first with a more muscular and expandable NOS than NetWare.

THE UNIVEL CONNECTION

Novell had already been working with the USL people, of course: Univel, an alliance between the two companies, shipped Unixware in late 1992. Unixware, a full-fledged Unix implementation of NetWare, moves the NetWare client code into its Unix kernel, making Unix clients run better and smoother on NetWare LANs.

On USL's side, NT has also been a threat: Just as Pieper's revamping of the company and insistence on standardization is making headway, along came Microsoft, playing spoiler to his vision of Unix as a NOS for serious computing. USL needed a big, rich, powerful ally. It found one.



The merger of two operating system giants may finally lead to a standard version of Unix.

Will the move pay off for Novell?

Unix has long had five problems: It can be an infuriatingly complex, ugly, and obscure beast to use; it places heavy demands on system resources; it is linked in the computer community's mind with technical workstations; it exists in many uncontrolled and incompatible forms; and

Illustration by Nishan Akgulian

HOW TO AUTOMATE YOUR FAVORITE DESIGN TOOLS

Generic CADD 6.0 works just like the tools you're used to. So using CADD is natural. You'll quickly produce everything from concept sketches to final working drawings. And at $495, your new tool kit can pay for itself on your first design revision. To find out why over 300,000 of your peers have automated with Generic CADD software, call 1-800-228-3601.
Ask for Info Pak #A95.

PC MAGAZINE EDITORS' CHOICE

AUTODESK

INFO WORLD PRODUCT OF THE YEAR 1992
Generic CADD Version 5.0

Copyright 1992 Autodesk Retail Products. All rights reserved. Generic CADD is a registered trademark of Autodesk Retail Products. Autodesk and the Autodesk logo are registered in the U.S. Patent and Trademark Office

CIRCLE 091 ON READER SERVICE CARD

PROTECT YOUR COPIES OF PC MAGAZINE

Make your collection of *PC Magazine* a handsome addition to your office or home—*and protect and organize your copies for easy reference!*

PC Magazine Binders and Cases are made of durable, luxury-look leatherette over quality binder board. Custom designed for *PC Magazine*, every order receives FREE transfer foil to mark dates and volume numbers.

FOR FAST SERVICE CALL TOLL-FREE 1-800-825-6690

MAGAZINE BINDERS
Hold your issues on individual snap-on rods. $9.95 each; 3 for $27.95; 6 for $52.95.

OPEN BACK CASES
Store your copies for individual reference. $7.95 each; 3 for $21.95; 6 for $39.95.

PC MAGAZINE

Please send ☐ Binders ☐ Cases Quantity _____

Payment enclosed $_____.* Add $1 per case/binder for postage & handling. (Outside USA, add $2.50 per case/binder ordered, US currency only.)

Charge my:
☐ Amex ☐ Visa ☐ MC (Minimum order $15)

Card No. _____ Exp. Date _____

Mr./Mrs./Ms. _____
Please Print Full Name

Address _____
No P.O. Numbers Please

City _____

State _____ Zip _____

*PA residents add 6% sales tax

Jim Seymour

there has never been a single, market-driven source pushing hard for popularizing a truly standard version.

The Novell deal will certainly solve one of those problems, and it may help with two more. As Soft*Letter editor Jeffrey Tarter has said, Unix will now have a very loud cheerleader working for its success. However Novell fits Unix into the NOS picture, it didn't buy Unix Systems Labs just to take a competitor off the table. Ray Noorda and company will be working hard—with a powerful financial incentive—to extend the reach of their single standardized Unix.

The Novell acquisition may also help on two more fronts. Novell has never been known for good-looking interfaces; the Open Look Unix interface was the best GUI I've ever seen, but it did not exactly take the market by storm. But the company's market savvy may help put a more civilized, if not yet pretty, face on the beast.

And finally, Novell's focus on the business computing marketplace, as opposed to the scientific/technical world, may also help shed a little of the Techies-Only reputation of Unix.

So, I see the Novell purchase of USL as a big plus for Unix's future.

In the end, the real questions—perhaps I should say paradoxes—of the Novell/Unix deal are these: How will Novell fit this unwieldy new product into its business plan? And will Novell, as the owner of the putative "open standard," finally be able to establish and control a standard Unix?

My guess on the first question is that Novell will position USL Unix as a higher-end, bigger-network alternative to NetWare, will continue Univel's progress on making Unix-based workstations something better than second-class citizens on NetWare LANs, and will develop network-management tools that work across both systems.

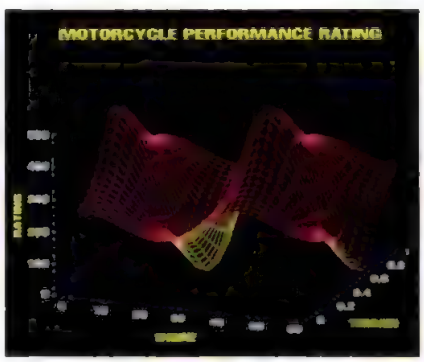
On the latter, I'm not so sure. Sun Microsystems can tell you, from its SPARC experience, just how tough it is to own an open standard. Novell/USL will either have to maintain all the USL licensees' juicy (and often very profitable) proprietary incompatibilities among versions of Unix, or it will have to knock some very big heads together in the interest of standardization.

Ray Noorda's a pretty good head-knocker: Look for Novell to push *very* hard for one standard version of Unix. ☐

We've Added Extra Power To An Already Great Ride. New STATGRAPHICS *Plus* Takes You Farther.

YOU DON'T HAVE TO BE AN EXPERT TO HANDLE NEW STATGRAPHICS *Plus* FOR THE 386/486.

If you've been wheeling around statistics for any time at all, you probably already know about STATGRAPHICS®, the statistical graphics system that anyone can use to quickly analyze data and *see* the results. The package that offers over 250 different statistical procedures, including regression analysis, ANOVA, quality control, experimental design, multivariate methods, forecasting, and much more. The product that Software Digest rated #1 for ease of use and learning. Now, we've done the only thing left to improve it: we've added all the horsepower you could want.



THE POWER AND SPEED FOR THE FAST TRACK.

If you've got a 386- or 486-based PC, grab your racing helmet. Because anything STATGRAPHICS can do, STATGRAPHICS *Plus* can do up to 5 times faster. And since it utilizes all of the RAM in your computer, it can handle the largest problems, including those that other stat packages choke on. And everything in this powerful new product works just like in STATGRAPHICS, right down to its easy-to-use menus and ability to import data from Lotus®, dBASE®, ASCII, or DIF files.

THINK OF IT AS A BETTER WAY TO SEE THE BIG PICTURE, FASTER.

Call today for more information and a free demo disk. And let STATGRAPHICS *Plus* keep you from spinning your wheels waiting for solutions.

STATGRAPHICS

In Maryland, (301) 984-5123.
Outside the U.S., (301) 984-5412.

(800) 592-0050 Ext. 200

Manugistics, Inc., 2115 E. Jefferson St., Rockville, MD 20852. STATGRAPHICS is a registered trademark of Statistical Graphics Corporation. Other trademarks are the property of their respective owners.
Evaluation © Software Digest Ratings Report, Vol. 8 No. 5 issue covering Statistics Programs. STATGRAPHICS *Plus* runs on 386, 386SX, and 486 computers with at least 4 MB of RAM and a graphics card. © 1992 Manugistics, Inc.

CIRCLE 365 ON READER SERVICE CARD

NETWORKING FOR THOSE TRYING TO RUN A BUSINESS. NOT A COMPUTER.

If you're a Windows user, Windows for Workgroups is the easiest way to network. If you're not using Windows, it's one of the best reasons to start.

No matter what business you're in, you stand to do a lot more of it when all your PCs are working together. And Microsoft® Windows™ for Workgroups is the easiest way to connect them.

Everyone benefits from a network. You can share letters and memos. And you can share one printer instead of buying several. Groups can develop reports together. Departments can work on common files. And everybody can have access to the latest (up-to-the-nanosecond) customer database or even an accounting system. Of course, Windows for Workgroups has security features in case you don't want everybody up on all the latest.

We could tell you how well Windows for Workgroups works. But it might be more convincing if you heard it from someone like you, who doesn't have a lot of time to spend running computers.

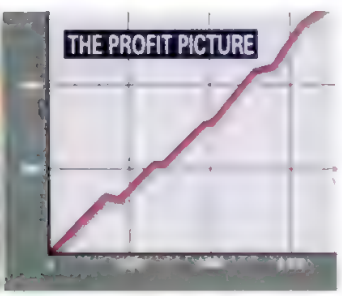
Crest Oelke at Dairy Queen of Greater St. Louis decided on Windows for Workgroups after watching 4 of his employees try to manage the accounting for 3 operations. Now they don't have to enter the same inventory, payable and receivable data into several PCs. Instead, they enter it once into their accounting package and it's a done deal, making everyone's life a lot easier.

Over the next year, Crest figures he'll save around $30K. Money that might be spent on more important things. Like ice cream.

Getting started is easy. Both in effort and in money spent. You can do it yourself. Or we can put you in touch with someone who can help. Call us at (800) 426-9400, Department JM7.

And start networking with Microsoft Windows for Workgroups. You'll be amazed how little time you spend on your PC.

And how much more time you can spend on your business.

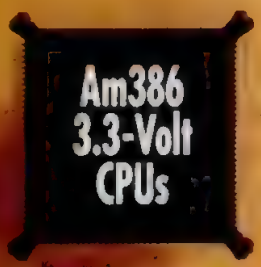


Left: Windows for Workgroups makes it easy for groups to share files and information. Right: Which makes it much easier for you to show a profit.

Microsoft
Making it easier

© 1993 Microsoft Corporation. All rights reserved. Printed in the USA. In the 50 United States, call (800) 426-9400, Dept. JM7, for more information or a reseller referral; customers in Canada, call (800) 563-9048; and outside the 50 United States and Canada, call (206) 936-8661. Microsoft is a registered trademark and Windows and the Windows logo are trademarks of Microsoft Corporation.

Low. And Behold.



No one ever imagined we'd sink so low. But we did. All the way down to 3 volts. And the editors at *PC Magazine* praised us for it. They named our Am386®SXLV and Am386DXLV microprocessors the year's best components.

This comes as no surprise to all of us here at AMD. We pioneered low-power CPU technology and were the very first to deliver 3-volt CPUs which, as *PC Magazine* put it, "sip rather than gulp."

It's an honor being singled out for technical excellence, particularly among finalists like Intel's clock-doubling DX2™ chip and Hewlett-Packard's matchbook-sized Kittyhawk drive.

But what pleases us most is that the world is acknowledging what we've known all along—*AMD is a true leader.*

Now we're leading the way for companies like Panasonic and Toshiba to develop low-voltage portables powered by smaller, longer-lasting batteries.

You can get all the award-winning details by calling AMD at **1-800-222-9323.** Ask for Literature Pack 15B. You'll see why customers are following our lead. And competitors are following our footsteps.

Advanced Micro Devices

Microprocessors For The Masses.℠

901 Thompson Place, P.O. Box 3453, Sunnyvale, CA 94088 © 1993 Advanced Micro Devices, Inc. Microprocessors For The Masses is a service mark and Am386 is a registered trademark of Advanced Micro Devices. All other brand or product names are trademarks or registered trademarks of their respective holders

CIRCLE 047 ON READER SERVICE CARD

Bill Howard

The Politically Correct PC

The green PC? Environment-conscious computing? The politically correct PC? Whatever its name, there's a movement to make PCs, peripherals, and packaging use less power, give off fewer emissions, and take up less landfill space.

Computer buyers should track the p.c.-PC phenomenon for three reasons. First, a new generation of PCs and peripherals could save energy and make your office a cleaner, cooler, and possibly safer place to work. Second, whether or not you give a rap about this personally, your company probably has a Green Committee with support at the highest levels, and you ignore it at your peril. Third, the government has gotten interested in the issue, and our government has a history of well-intentioned, individually competent civil servants banding together and promulgating rules whose costs cancel out their benefits. You should watch them like a hawk.

What is a politically correct PC? The most common attributes include monitors with low electromagnetic emissions and PCs that use less power, minimalist cardboard packaging, and toner cartridges and used nickel cadmium batteries you return for safe disposal. But there's much, much more to the concept.

Environmentally conscious computing also embraces flicker-free monitors and nonglare displays. It means whisper-quiet PCs and printers, ergonomic desks and chairs, nonglare lighting, and more comfortable keyboards. In the manufacturing process, it means using soap and water rather than solvents to clean circuit boards. It means using CD-ROM—not paper—user manuals.

The hottest concept is the low-power PC. A typical PC and monitor draws 150 watts today. The EPA wants vendors to build systems with a mode that draws no more than 30 watts for the system unit and 30 watts for the monitor at idle. That's a key reason Intel is adding the power-down attributes of the laptop-oriented SL chip to its DX chip line.

Products that meet these specifications will receive EPA "Energy Star" certification and logo, an adult version of the gold star you got on your forehead in first grade. Such a system would use about $12 a year of electricity, versus $35 a year for a traditional system. It would also reduce your air conditioning load: It takes about 1.5 watts of cooling energy to offset each watt of energy your PC consumes.

Some situations are win-win. Kyocera's silicon-coated Ecosys laser-printer drums last forever, and as a result, each copy costs less than a penny rather than 2 to 3 cents. But you'll find trade-offs, too. If your next monitor goes into power-down rest mode (not just screen-blanker mode, which saves no energy), you'll wait 5 or 10 seconds until it comes back to life.

Then there's the hype. One PC vendor's cardboard box proclaims, "We support recycling," even though the inks and coatings on the box preclude recycling.

Why think about green computing? Because in the long run it will save energy and money.

WHAT YOU CAN DO

Here are a few things you can do: Add a duplexing attachment to your laser printer and print on both sides in order to save paper. Get a high-resolution monitor and use print preview before you print. Send electronic mail, not paper mail. If you're torn between an ink jet and laser printer, get an ink jet; it uses far less power. If you have a laser printer, change or service the ozone filter regularly.

If you need remote access, get a black box that powers up the system when the modem line rings. Try PhoneBoot from Cybex (205-534-0011) for $395; keeping your PC on around the clock consumes about $105 a year in electricity. The payback is partly psychic. But it's a start. □

Illustration by Nishan Akgulian

ONLY THE

In today's aggressive business environment, long-term survival is a matter of strength. And nowhere is this more true than in the computer industry.

Size is strength. With annual revenue of over $1.2 billion, Acer is one of the world's ten largest PC manufacturers. And with 50 international offices and 10,000 dealers in 70 countries, Acer systems are available to single users and corporate sites around the world. Our global presence allows us to provide an unsurpassed level of service and support.

Self-reliance is strength. At Acer, we don't rely on other manufacturers to build our computers—we make Acer systems out of Acer components. This allows us to better control the manufacturing process, ensure quality and pass the savings along to our customers.

Benefit from our strength. Quality. Acer was one of the first to receive the ISO 9002 award—the most coveted international recognition of manufacturing quality and excellence. Affordability. You get the widest range of top-quality computers at the most affordable prices.

So if you're concerned about the long-term survivability of your computer manufacturer, depend on a company that has the strength to endure. Depend on Acer. Only the strong survive.

STRONG SURVIVE

Rated #1 Overall
" THE QUEST FOR THE BEST PC"
Feb. 1993

PC WORLD BEST BUY

"Performance that tops that of other DX2/50s and rivals that of some of the 66MHz 486DX2s."

"Although we see great equipment every day, this PC is the kind of system we'd go out and purchase for ourselves..."

"This Best Buy came up with the combination of performance, price, expandability and design it takes to deserve first place among 25 systems..." – PC World *February, 1993*

"Needless to say the (AcerPower 486e) took first place in every test." – PC World *January, 1993*

intel inside

Based on 33, 50 and 66MHz Intel® processors, AcerPower™ delivers plenty of speed and performance for today's demanding Windows™ applications. But don't take our word for it—pick up the February issue of PC World and find out why the AcerPower 486e DX2/50 is a Best Buy.

FEATURES	MODEL 5367	MODEL 5567	MODEL 5667
CPU	486DX/33	486DX2/50	486DX2/66
MEMORY	4MB, Exp. to 256MB	4MB, Exp. to 256MB	4MB, Exp. to 256MB
CACHE	128K	128K	128K
HARD DISK	240MB	240MB	240MB
FLOPPY	3½"	3½"	3½"
ACCEL. VIDEO	Local Bus (1280x1024)	Local Bus (1280x1024)	Local Bus (1280x1024)
I/O	EISA	EISA	EISA
MONITOR	15" NI EVGA .28 Flat Square Overscan	15" NI EVGA .28 Flat Square Overscan	15" NI EVGA .28 Flat Square Overscan
SOFTWARE	DOS®, Windows™	DOS, Windows	DOS, Windows
WARRANTY	One Year On-site	One Year On-site	One Year On-site
MSRP	$2,799	$2,999	$3,199

Acer®

ONLY THE STRONG SURVIVE

Call 1-800-SEE ACER for a dealer or retailer near you

AcerPower is a trademark of Acer, Inc. i486 and the Intel Inside Logo are trademarks of Intel Corporation.
All other trademarks are the property of their respective owners ©1993 Acer, Inc.

CIRCLE 034 ON READER SERVICE CARD

APPLICATIONS INTEGRATION

Making Your Programs Work Together

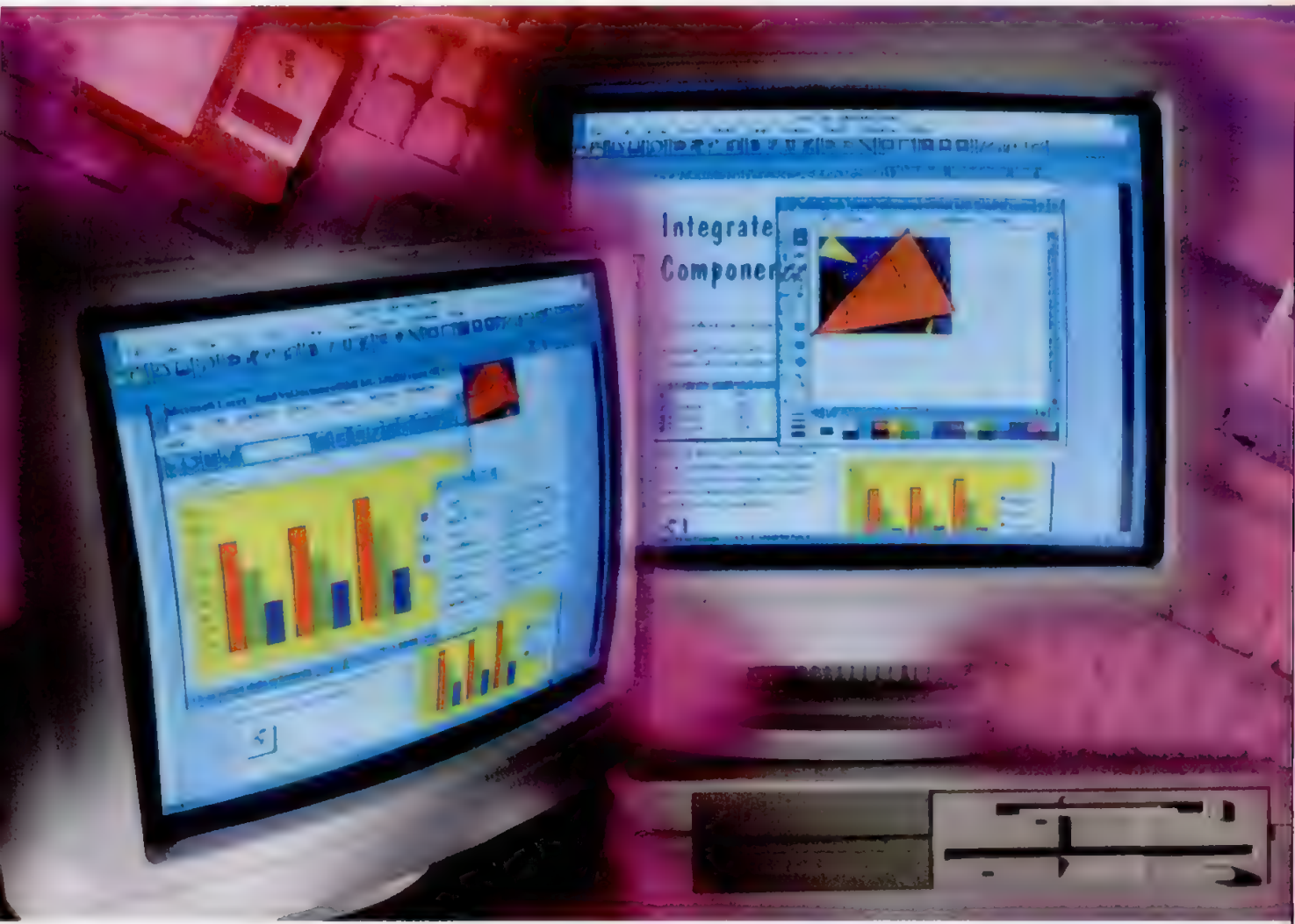
Photography by Christopher Gould

Integrating data poses new challenges for PC users. From file import to OLE, there are many ways to get programs to work together. This report helps you navigate through the thicket.

by Michael J. Miller

If you're like most *PC Magazine* readers, you have a word processor and a spreadsheet package. Perhaps you have a graphics or database program and other applications as well. But how do you get these programs to work together? How do you get information to move between applications? Are you better off buying one vendor's suite of software, or should you buy the best individual program in each category?

All of these are fairly new questions for PC users. Back in the days when DOS-based applications formed the vast majority of PC applications, there really wasn't much choice. Most users ran a single application at a time. A few hardy souls ran operating environments such as DESQview or Microsoft Windows that let you load multiple programs simultaneously. Others chose integrated packages such as Symphony or Microsoft Works. These offered multiple functions but tended to be self-contained.



Whatever integration was available among different programs was typically limited to simple file import/export capabilities.

Now, with more sophisticated applications being introduced for Windows—and to some extent for OS/2 as well—applications integration has become a reality, perhaps even a necessity. Today's graphical applications are designed for a world in which most users have multiple programs running simultaneously, and these applications can share information in multiple ways. Under Windows and OS/2, file import/export and translation features remain, of course, but they have been augmented by a common clipboard that offers cut, copy, and paste features between applications. In addition, there is Dynamic Data Exchange (DDE), a method of having information in one application automatically update information in another application. Windows also offers a version of Object Linking and Embedding (OLE) that lets you effectively place a second application and its data inside of your main application. In the future, more advanced versions of OLE, as well as other object-oriented techniques, will let you edit different kinds of information by using different applications accessible within a single document.

As we move toward applications integration, we may also be moving from an application-centric world of computing—where most of our data is contained in files within a single application—to a more document-centric world of computing, in which all sorts of information are contained in complex documents. Appropriate portions of a document can then be edited using one of many different applications tools.

In this report, we look at the spectrum of methods available for getting your applications to work together. We'll also explore why some methods are more appropriate for certain circumstances than others. The methods range from fairly simple, tried-and-true techniques to those that are still only glimmers on developers' drawing boards. But they have a common goal: to make your applications work together so that the combination is more useful than the sum of the individual applications.

Import/Export, Translations, and Direct Reads

The simplest way of sharing data between programs is to take a file created in one program and open it in another. While this sounds easy enough, the reality is not as tidy.

Today, most word processors can read files created in other word-processing programs and can save files to those packages' formats as well. Text usually transfers between these successfully, but properties such as fonts, layouts, columns, and graphics often transfer incorrectly, if at all.

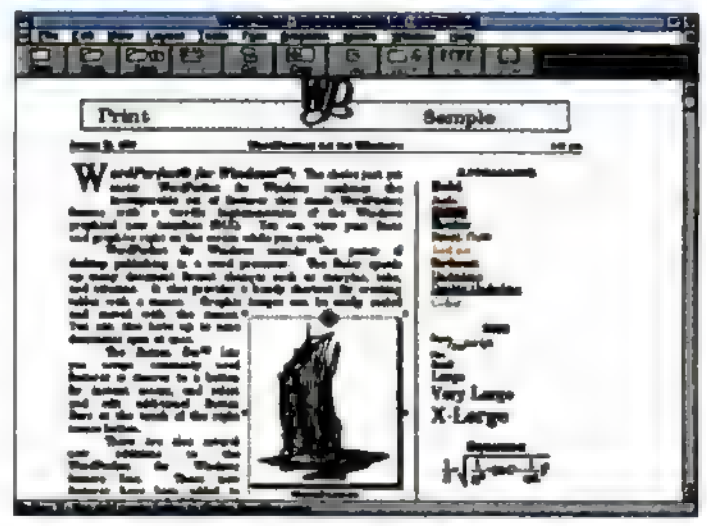
Integrating data in formats not directly supported by your word processor is also a problem. When no direct import is available, most word processors use file-translation filters. The filters are typically provided by one of two relatively small software vendors, Chicago-based Systems Compatibility Corp. and Phoenix-based Mastersoft. These companies also offer their own translation programs. Systems Compatibility Corp.'s Software Bridge and Mastersoft's Word for Word, Word for Windows Version, are popular tools for those who translate file formats frequently. When no translation filters are available, you can nearly always save your text in ASCII format, transferring the text without any formatting.

Spreadsheets involve more complexity. Programs such as Microsoft Excel read the various Lotus 1-2-3 formats; 1-2-3 for Windows reads Excel files. However, this direct-read capability can be limited. 1-2-3 stores information in two separate files: .WK3 for data and .FMT for formatting. And neither 1-2-3 nor Excel reads Quattro Pro's file formats. As with word processing packages, data and formulas import fairly well; fonts, colors, and other sophisticated formatting are problematic.

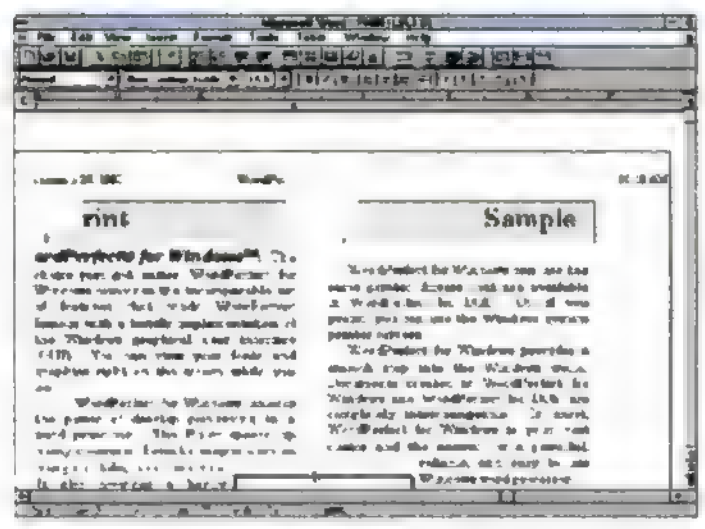
Macros add further difficulties. Both Quattro Pro and Excel execute 1-2-3 macros, but the Excel and Quattro Pro for Windows macros are unique to those packages. In the graphics arena, many programs have specialized formats, but fortunately there are large collections of standard graphics file formats that most programs support.

In addition to reading and writing files of their own genre, most programs also work directly with data from other types of applications. For instance, most word processors can read in spreadsheet cells or ranges. They usually can use .DBF files in their mail-merge operations. Spreadsheets typically can read in or export database files, and most are gaining facilities to access data from higher-end databases such as those that use the SQL (Structured Query Language) format. Nearly all of the graphical word processors and spreadsheet packages have facilities for reading in graphics directly.

File import/export is the simplest form of application integration. It's easy, fast, and direct. The original application needn't be present; you only need your program to support the import or translation of your data, typically via the Open or Import command. It makes sense to use import/export methods if you want quick data access, provided that data will not need any modifications.



Import and export features generally work quite well for text, but graphics and advanced formatting often do not transfer well. For instance, a document created in WordPerfect for Windows (above) may not look the same if you open it in Microsoft Word for Windows (below).



COMPANY STRATEGY

Microsoft Corporation

Microsoft often describes its strategy as "Windows, Windows, Windows." Certainly Microsoft is pushing its own standards for applications integration as part of its Windows environment. Part of the push involves developing its own applications and tools to exploit these standards.

Windows for Workgroups' Clipbook

Microsoft has developed a suite of integration tools, ranging from Object Linking and Embedding (OLE) for the desktop to Messaging Application Programming Interface (MAPI) to Open Database Connectivity (ODBC) and the Windows Open Services Architecture (WOSA). Each is designed to make different kinds of information and services accessible through Windows. These tools make Windows APIs the communications glue among multiple applications.

While Microsoft emphasizes the Windows environment, it also promotes versions of MAPI and OLE for the Macintosh. But it doesn't discuss the entire spectrum of cross-platform application support with the same fervor as other vendors do. Instead, Microsoft concentrates on Windows and Macintosh.

Microsoft believes in an incremental approach to application integration, from the Windows clipboard through Dynamic Data Exchange (DDE), OLE 1.0, and now OLE 2.0. With its support for in-place editing, drag-and-drop features, and better programmability, OLE 2.0 will make creating compound documents easier.

Not surprisingly, Microsoft's own applications group is a big supporter of OLE 2.0. Vice president of desktop applications Pete Higgins says the company plans to incorporate OLE 2.0 features in future releases of its mainstream applications.

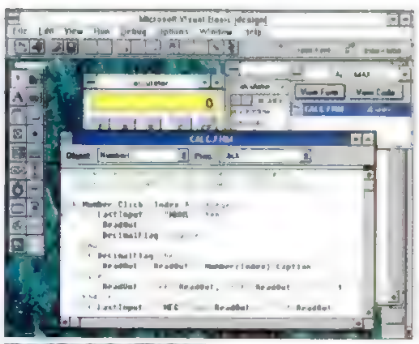
As a part of OLE 2.0, applications will expose many of their features as programmable interfaces that can be controlled by macro languages. For its own applications, Microsoft is developing Object Basic, a common macro language that can be shared by most Microsoft applications, from spreadsheets to databases. Depending on the kind of application there will often be extensions to the language says product manager Tom Button. Higgins says he expects desktop applications to move toward Object Basic over the next 18 months.

OLE 2.0 and Object Basic work together but are not dependent on each other, comments Microsoft executive vice president Mike Maples. OLE 2.0 is an open specification; software development kits are already available. Object Basic is Microsoft's proprietary language that it uses in its own applications.

As the need for integration increases, Maples believes, customers will begin buying basic sets of productivity tools (such as Microsoft Office or Lotus SmartSuite) and subsequently add customized tools geared specifically to the end user's line of business. Sales of Microsoft Office have been growing, and Higgins believes that by the end of the year, more copies of Excel will have been sold as part of Microsoft Office than as a standalone spreadsheet.

This poses new challenges, both to Microsoft and other vendors, because users have rising expectations about the consistency of products from the same vendor, particularly if the products come in the same box. Higgins emphasizes that adding consistency to common menus, dialog boxes, and even the placement of tools within the toolbar will become more important to Microsoft in the future. He adds that products such as Microsoft Office will reflect efforts to remove redundant components and include macros that will be designed to help the products work together.

Microsoft describes OLE 2.0 as a "step on the road to Cairo," referring to a future, more object-oriented version of Windows. Cairo's architecture will combine an object-oriented file system with elements of OLE, WOSA, and the Win32 API. It will have more drag-and-drop capabilities and a better way of tracking the movements within compound documents. Central to this file system is the ability to retrieve objects based on both properties (such as file names or creation dates) and contents (the information—both text and other—that exists within your objects).

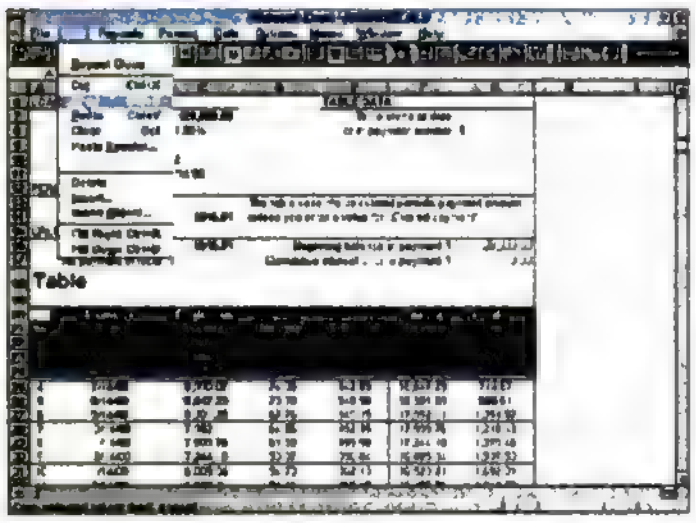


Visual Basic for Windows

Microsoft plans to preview Cairo this fall and release it sometime in 1994. The company expects it to fill a major role in Microsoft Chairman Bill Gates' vision of "Information at Your Fingertips." □

CUT, COPY, AND PASTE

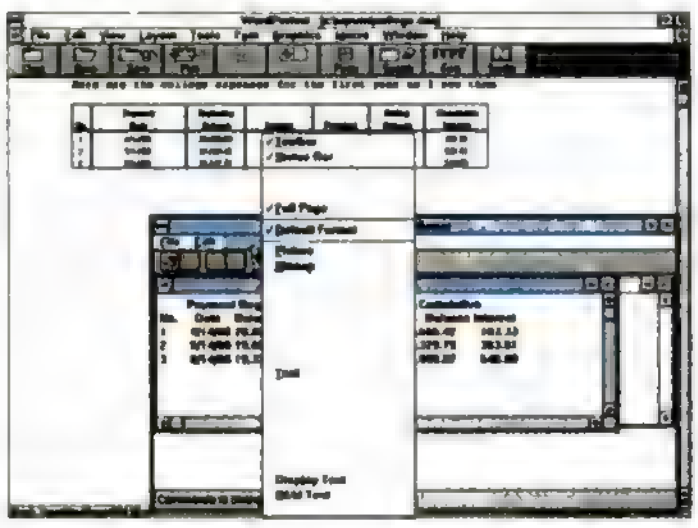
One problem with directly reading data is that the host application needs to know about specific file types in order to import them. Besides being a lot of work for the developer, translation support on a format-by-format basis is redundant for us-



Cut, Copy, and Paste achieve application integration via a shared clipboard. Clipboards are part of Windows (above), OS/2, and the Macintosh. Microsoft Excel will let you copy a cell or range of cells to the clipboard by typing Control-C or by choosing the copy icon or Edit Copy menu command.

ers. A more generic solution is provided by the common clipboard in the Macintosh environment, Windows, OS/2, or a number of other graphical operating environments.

Typically, each application in such an environment has cut, copy, and paste commands. When you cut or copy something with your application—whether text, spreadsheet cells, or a graph—you are placing it on the clipboard; you can then paste it into any other application.



Once information is on the clipboard, it can be pasted into another application. WordPerfect lets you do this using a menu command, keyboard shortcut, or button bar. You can see clipboard contents with Windows' Clipboard accessory.

This isn't quite as simple as it sounds. When you paste data from the clipboard into your application, the application has to accept that data in a form it understands. In most cases, this means that the original application places the data on the clipboard in multiple formats, and the target application chooses the format it knows best. The data usually survives, but it may lose some underlying detail. For instance, if you copy spreadsheet data into a word processor, you typically get the values and the formatting, but not the formulas behind the values.

When you cut, copy, and paste information, the information becomes a part of the application you are bringing it into, just as with file import. For instance, if you bring a graphics file into a word processor, you might be able to edit it with the word processor's drawing tools (if there are any); you should at least be able to display it. You cannot, however, use the editing commands of the original application any longer. Nor can you change the data in the original application.

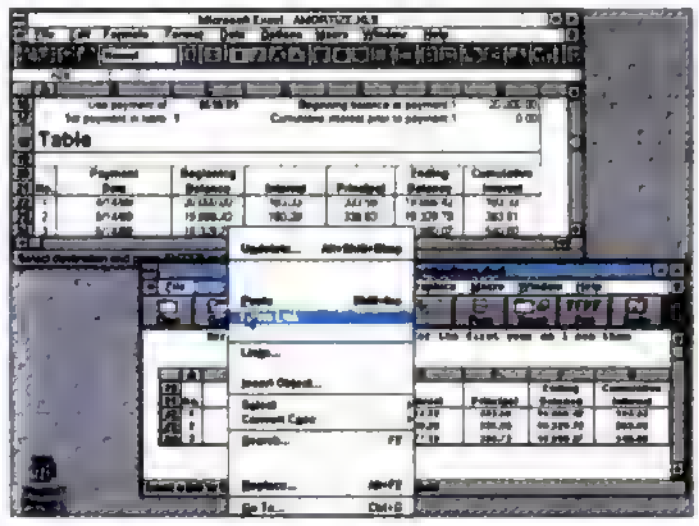
The clipboard is limited to storing a single item at a time. Several vendors offer more powerful variations on the clipboard. The Macintosh Scrapbook, Eikon Corp.'s Scrapbook Plus for Windows, and the Windows for Workgroups Clipbook all let you store multiple sets of data in a common area. These can be stored and viewed, then pasted later. But in general, cut-and-paste works best when you have both applications on the same system and want to import data that will not change once it has been brought in.

LINKING: DATA BECOMES DYNAMIC

Sometimes information changes. That's when you want the data you bring into your application to be dynamic, not static. Often you'll want this type of data in a compound document—a document made up of data created using a number of different applications. With a compound document, you can edit the various elements or objects, using the applications that created them.

Creating a compound document offers choices. The data can be linked, so that the original data continues to be stored in a separate file, or embedded, so that both the data and the details about the application that edits it are stored in the compound document.

Linked objects are useful if there is one central file whose data is shared by multiple people or multiple documents. When you use a link, the information is displayed in the target application, but



With DDE, information can be linked instead of pasted. The range is copied in the spreadsheet but linked into the word-processing document through an Edit/Paste/Link command. This lets any changes in the spreadsheet be reflected in the word-processing file.

the source data is stored elsewhere. The compound document contains a reference to the location of the file that stores the data. Thus, you can make changes to the data in the original application that will be reflected in any document that has a link to that file.

In Windows or OS/2, this linking is accomplished through a Windows feature called Dynamic Data Exchange (DDE). The OLE 1.0 specification is built on DDE and includes the same kind of linking. Typically, you link information by copying it to the clipboard and choosing a Paste Link or Paste Special command in the target application. The two applications then exchange not only the data but information on where it is stored and how it should be displayed as well. Many applications let you specify certain options, such as whether an object should be pasted as text, a picture, or a bitmap. When you click on linked data, you are immediately transferred to the application that created the data. If you update the data, the change is automatically reflected in the main document.

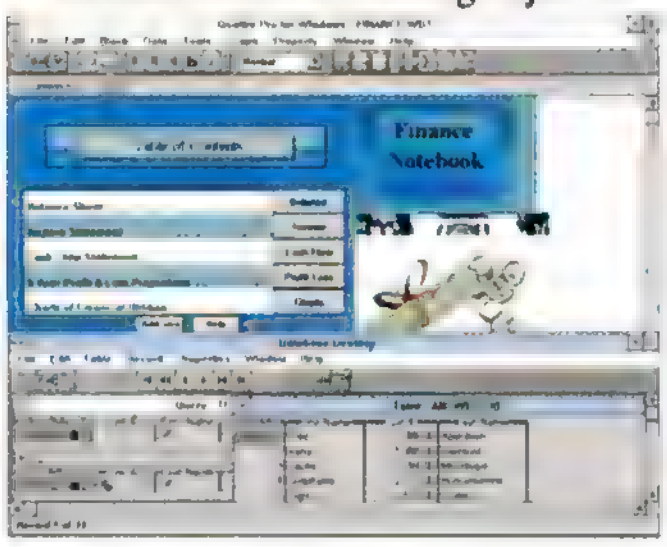
Most applications give you the option of turning off these automatic updates, in which case there is typically a command

COMPANY STRATEGY

Borland International

Object orientation is more than an application integration strategy at Borland International. For years, it has been the way the company looks at and talks about its development efforts.

Borland has been touting object orientation for a long time, most notably in its tools area with products such as Borland C++ and Pascal. These products are object oriented in the classical sense, supporting class libraries, inheritance, and encapsulation.



Quattro Pro for Windows

An end-user approach to object orientation comes through in the firm's spreadsheet and database products. CEO Phillipe Kahn says that Paradox and Quattro Pro for Windows are "object oriented from the ground up." Borland pioneered the use of the right mouse button as an "object inspector" in its productivity applications, and Kahn continues to point to his company's implementation as being different from the "shortcut menus" other companies have implemented.

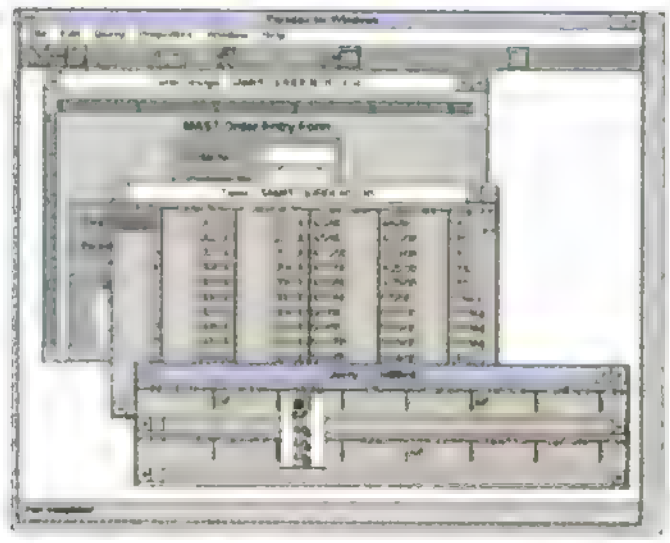
Reusable components—key elements in what the company calls its Borland Object Component Architecture (BOCA)—are already evidenced in the firm's graphical products. Stephen Kahn, senior vice president, products division, says that components visible to the end user, such as table editing, report writing, and query tools, should be shared. This philosophy is evidenced by the way Quattro Pro for Windows uses the same database query interface as the one developed for Paradox for Windows. Borland's products will share query tools, a database engine, graphic tools, a user-interface toolkit, and @ function libraries. In the long run, Stephen Kahn sees the notebook metaphor used in Quattro Pro for Windows extended to other products as well—in a more object-oriented environment.

The database engine is central to many of the products and is used by ObjectVision, Quattro Pro for Windows, Paradox, the forthcoming dBASE for Windows, and many of the languages. This engine, in turn, can connect to native Paradox files or dBASE .DBF files via the firm's Open Database Application Programming Interface (ODAPI). This API effort was recently joined by IBM, Novell, WordPerfect, and other vendors to become the Independent Database API (IDAPI), which those companies are promoting as an alternative to Microsoft's Open Database Connectivity (ODBC) standard. Borland promotes IDAPI as being more transparent and able to support more features (such as the ability to join tables in multiple formats to create a virtual table) than ODBC.

The company plans to use IDAPI to connect its desktop products to other products, including its Interbase server. Interbase, now available only on larger systems, is being positioned as a server-based client-server-based solution for on-line complex processing, particularly for environments with more complex data types. Rather than into a single cross-platform macro language, Borland is putting its program hooks into its products so that they can be controlled by the language of your choice, including the company's C++, Pascal, Object Pal, and dBASE languages. "People want to use different languages," stresses Stephen Kahn.

Although Phillipe Kahn has been one of Microsoft's most persistent critics, his company is emphasizing Windows in its productivity applications. "It's a Prisoner's Dilemma," he says, because the act of developing products for many platforms defocuses you.

Kahn feels that Microsoft's published specifications for standards such as OLE aren't adequate and that Microsoft's plans for making Windows object oriented don't go far enough. "We ultimately need the operating system to be object-based from the ground up," he says. Kahn wants features such as distributed object computing over a network. He supports open standards, such as the Object Management Group and its Object Request Broker, as opposed to the standards Microsoft is promoting. Nonetheless, he says, the company will support the Microsoft standards as well, backing Vendor Independent Messaging (VIM) and Messaging Application Programming Interface (MAPI) for mail enabling and using IDAPI to get to ODBC.



Paradox for Windows

Borland doesn't market a word processor, so it is working to make sure its products integrate with other word processors, especially WordPerfect. It is convinced that customers should not concentrate on suites of applications but, rather, should buy the "best of breed" application. □

Preferred Stock For The Price Of Common.

*Depending on applications used, power management features selected, and peripherals attached. Terms: MasterCard, Visa, Discover and American Express accepted. No surcharge for credit card orders. Money orders, certified checks, personal checks accepted (allow ten days for processing). Company and institutional P.O.'s upon credit approval. ZDS resellers and distributors determine their own pricing which may be higher or lower than ZDS' Z•DIRECT price. Prices do not include applicable sales tax, shipping and handling. Government, Educational and Volume Purchase buyers please call for a quotation. Federal Government Sales please call 1-800-843-4131. 30-day money-back guarantee applies only when buying through Z•DIRECT. Excludes opened software and purchases which have been subject to abuse. Some models shown with optional accessories. Most notebooks include one-year limited mail-back warranty with optional Z•CARE service available (call, or see a Z•CARE contract for important details). Order by FAX 1-800-472-7211. All products subject to availability. Specification and prices subject to change without notice. Zenith Data Systems is not responsible for typographical or photographic errors. Z•NOTE, Z•SPORT and READYDESK are trademarks of Zenith Data Systems Corporation. MS-DOS and Microsoft are registered trademarks and Microsoft Windows, Microsoft LAN Manager and Microsoft Windows for Workgroups are trademarks of Microsoft Corporation. i386, i486 and the Intel Inside logo are trademarks of the Intel Corporation. Novell and NetWare are registered trademarks of Novell, Inc. Banyan and VINES are registered trademarks of Banyan Systems, Inc. Copyright © 1993 Zenith Data Systems Corporation

ZDS▪600 Series

FROM $1299 i386™SL/20-25 MHz • 60-120MB HDD • 3.5″ FDD • 2MB RAM user expandable to 8MB • 9.5″ VGA display • MS-DOS® 5.0 • serial, enhanced parallel, video, mouse/keyboard port • internal modem socket • up to 3 hours NiCad battery life • 6.5 lbs.

Z▪SPORT™ 325S

SAVE $400 i386SX/25 MHz • 60MB HDD • 3.5″ FDD • 2MB RAM user expandable to 8MB • 9.5″ edge-lit LCD • MS-DOS 5.0 • NiMH battery • optional ISA docking unit • serial, parallel, mouse, video port • 6 lbs.

Z▪SPORT 420S

SAVE $550 i486™SX/20 MHz • 85MB HDD • 3.5″ FDD • 4MB RAM user expandable to 16MB • 9.5″ edge-lit LCD • MS-DOS 5.0 • NiMH battery • optional ISA docking unit • serial, parallel, mouse, video port • 6 lbs.

Z▪NOTE™ 325L

SAVE $400 i386SL/25 MHz upgradable to i486SL • 85MB HDD • 3.5″ FDD • mouse • 4MB RAM user expandable to 12MB • 9.5″ LCD upgradable to color • MS-DOS 5.0, Microsoft® Windows™ 3.1, and Microsoft Windows for Workgroups™ • Ethernet compatible high-speed-communications port • pre-installed client software for Novell® NetWare,® Microsoft LAN Manager™ and Banyan® VINES,® • up to 10 hours NiMH battery life* • optional READYDESK™ Port Replicator • 5.9 lbs.

Z▪NOTE 325Lc

SAVE $500 i386SL/25 MHz upgradable to i486SL • 120MB HDD • 3.5″ FDD • mouse • 4MB RAM user expandable to 12MB • 8.4″ active-matrix color display • MS-DOS 5.0, Microsoft Windows 3.1, and Microsoft Windows for Workgroups • Ethernet compatible high-speed-communications port • pre-installed client software for Novell NetWare, Microsoft LAN Manager and Banyan VINES • up to 6.5 hours NiMH battery life* • optional READYDESK Port Replicator • 6.5 lbs.

Introducing new Z▪DIRECT pricing, starting at $1299. At Zenith Data Systems, we set the standard for notebooks others can only aspire to. Now, we pledge you our entire line of ZDS notebooks at rock-bottom low prices. From our light-weight, entry-level ZDS▪600 Series starting at $1299, to our upgradable Z▪SPORT notebooks with desktop expansion and our award-winning Z▪NOTEs with upgradable display, built-in networking and industry-leading battery life. So, for jackpot notebook quality at anybody-can-play prices, call Z▪DIRECT today. Or see your nearest reseller.

intel inside

Call Z▪DIRECT At 1-800-289-1254.

ZENITH DATA SYSTEMS

A Bull Company

Thinking Ahead.

DDE in action lets you change data in the spreadsheet file and have those changes show up in your documents. When both files are open, the change shows up immediately. Otherwise, you could "refresh" the links when you opened a document that referred to the spreadsheet data.

to update or refresh the links manually. Similarly, when you open a document that contains a link, it usually asks you if you want to update or refresh the links; it then goes out and checks for new data.

DDE links can be confusing. You can edit the data in your target document, but the changes will be overwritten if the links are refreshed. If you change a filename or move your source document, you must manually edit the information pertaining to your links. If you pass someone a document that contains a link, the transmitted data may not be current because the link will not be active.

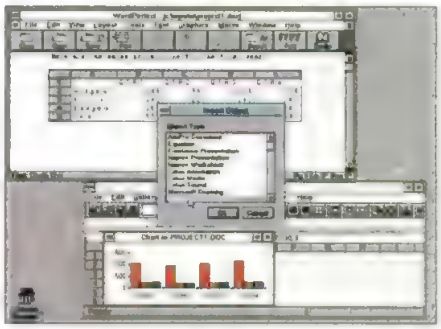
Because of the constant communications between applications, DDE can be slow. DDE in Windows 3.1 works only on a single machine, although Network DDE recently shipped in Windows for Workgroups.

Linking is a good choice if you have data in a compound document that needs to be updated regularly, as long as you don't need to edit it within the compound document itself. This strategy makes particular sense when you have data shared by multiple users or multiple documents.

OLE 1.0: Embedded Objects

When you embed data, you not only integrate the data itself, you also integrate the instructions on how to manage that data. Both the data and the instructions are stored within the compound document. In other words, the object (the data with its full set of characteristics, such as fonts, color, format, and formulas) actually becomes a part of the document. This increases the size of your file because there is additional information, but it also means the document can travel more easily to another machine or directory.

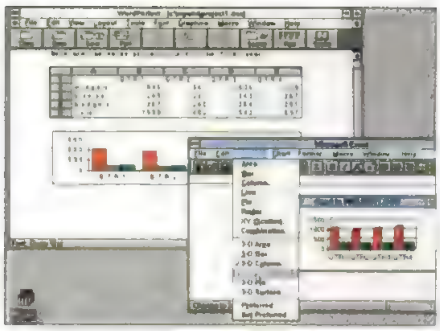
In the Windows environment, embedding came about following a 1988 proposal from Aldus Corp. for an "extended DDE" (Dynamic Data Exchange). Ultimately, this evolved into the OLE specification, which was developed by Microsoft Corp. with input from Aldus, Lotus Development Corp., and many other vendors. OLE (Object Linking and Embedding) was first implemented as a series of libraries shipped with applications such as Lotus Notes and Microsoft Excel and later included in Windows 3.1.



With OLE, you can put an object created using another program into your document. In OLE 1.0, you typically select an Insert Object or Paste Special command and then choose which object to insert from a list. Windows keeps a list of which objects can be inserted within applications.

OLE 1.0 allows the basics of embedding and is today implemented in various forms by about 150 Windows applications. An application can contain objects (in which case it is called a container or an OLE client), or it can act as an embedded object (in which case it is a component or an OLE server). Some applications do both.

In OLE 1.0, when you double-click on an embedded object, you launch that application in its own window. You can edit the object with the application that created it, but you can't see the context (the document) that surrounds it. For instance, PowerPoint uses an OLE charting module to create graphs for use in presentations. But when you launch that charting engine, you can't see other parts of the slide around your graph, so it's difficult to make the chart fit properly in your PowerPoint slide.



With OLE 1.0, when you click on an object in your compound document, the system opens the application that created it. You can then edit the object in a separate window rather than in the compound document itself; the changed object is returned to the container document.

Because OLE objects are a part of the compound document, they change only when you open them and want to change them. This makes them work faster than DDE, since the applications no longer need to communicate constantly. You can also easily give the compound document to another user of the main application, although the recipient won't be able to edit the embedded object without having the proper application.

You should choose OLE if you want to include a variety of objects in a single document and don't need to share these objects with other applications.

More Modular Applications

The move toward increasingly modular applications has become the rule rather than the exception. Today, most major applications come as a series of compatible programs. For instance, word processing packages typically come with separate spell-checking, grammar-checking, thesaurus, drawing, and charting components. Such modules often existed as overlay files in DOS applications, but in graphical environments they are frequently implemented as a series of dynamic link libraries (DLLs).

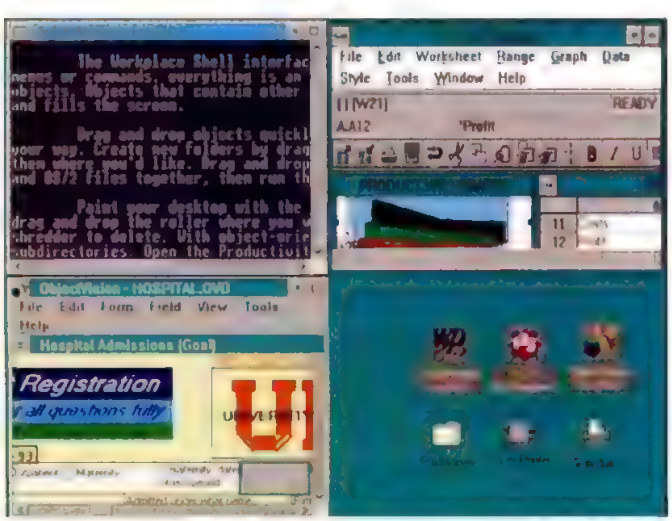
Vendors with multiple applications are trying to move to a scheme where their products would share these specific

Now you don't have to operate within the limits of the system.

Operate at a

Run DOS applications. Run Windows™ applications. Run OS/2® applications. Run them at the same time, in separate windows on the same screen. With OS/2, you can experience a whole new level of freedom and flexibility.

Drag a file object from one folder and drop it in another to move it. Drag a folder object and drop it on the shredder to delete it. Drag a file object and drop it on the printer to print it. In the OS/2 Workplace Shell,™ common procedures become intuitive clicks of a mouse.



DOS and Windows support is built in to OS/2, and you can explore over 1,000 OS/2 applications as well.

Copy text from DOS applications into Windows or OS/2. Or from anywhere to anywhere. Use Dynamic Data Exchange within or between OS/2 and Windows applications. Repaginate a Word for Windows document while printing a Harvard Graphics® chart while calculating a 1-2-3® spreadsheet while downloading files via modem. Instead of calling a file "boblettr.622," call it anything you want up to 256 characters long. Instead of

IBM and OS/2 are registered trademarks and Workplace Shell and OS/2 Crash Protection are trademarks of International Business Machines Corporation. Windows is a trademark of Microsoft Corporation. Harvard Graphics is a registered trademark of Software Publishing Corporation. 1-2-3 is a registered trademark of Lotus Development Corporation. © 1993 IBM Corp.

OS/2 Advantages:

Easy to use.
–Object-oriented Workplace Shell interface.
Improves productivity.
–Runs DOS, Windows and OS/2 applications.
–Pre-emptive multitasking.
–OS/2 Crash Protection.™
Advanced 32-bit architecture.
–Fully exploits 386SX processors and above.

start a communications session at a specific time or run programs when you want. OS/2 lets you take full advantage of the latest 386 and 486 technology.

To find out more or to order OS/2, call **1 800 3-IBM-OS2.** In Canada, call **1 800 465-1234.**

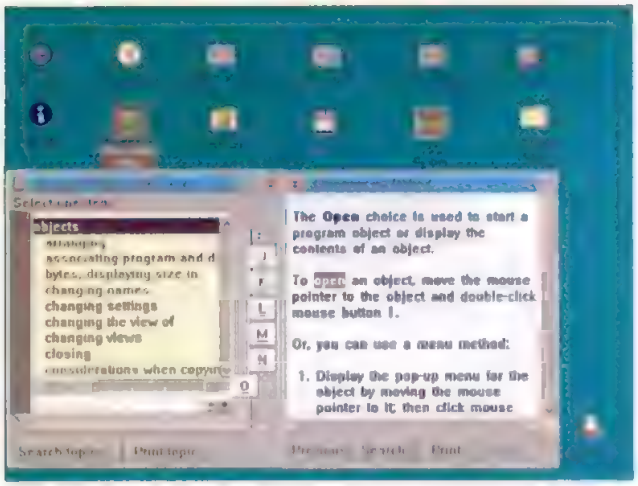
With OS/2, you can stop dealing with the limitations of the past, and start rising above them.

higher level.

working within the 640K barrier, take advantage of more of your computer's memory.

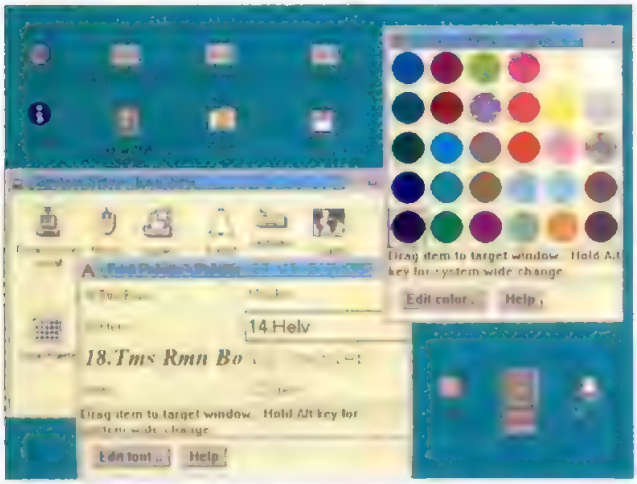
Use the PMSeek feature to search for files. Use the built-in ICON editor to custom-design your own icons. Use the Productivity Alarms object to schedule automatic backups,

IBM®

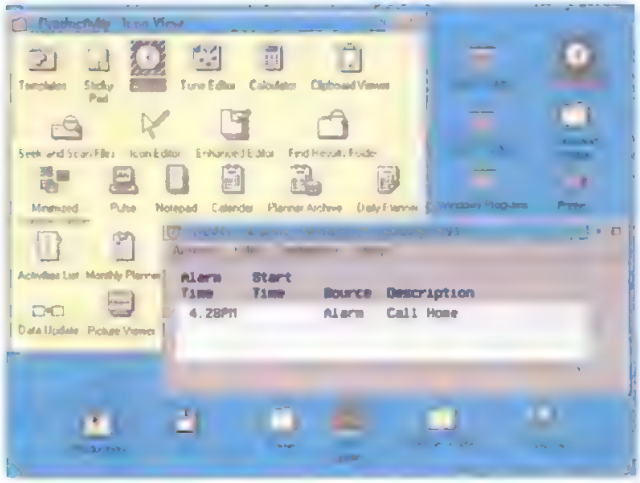


In the Workplace Shell, everything appears as an object. It's a simple, intuitive, more efficient way to work.

With built-in networking features, OS/2 was designed to excel in both standalone and connected environments.



Organize and customize your desktop to look and work the way you want it to.

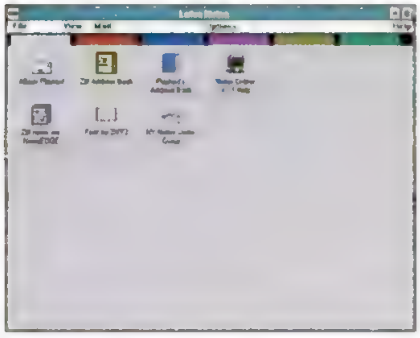


You can set alarms to remind you of events with the Alarms function in the Productivity folder.

COMPANY STRATEGY

Lotus Development Corp.

Lotus's application-integration strategy is centered on communications and networking rather than on a single document residing on a standalone workstation. While other companies talk about objects integrated into a compound document, Lotus envisions an environment where data of all kinds will be organized, coordinated, and shared through a communications vehicle. That vehicle is Notes, Lotus's groupware package, and cc:Mail, its electronic-mail product.



Lotus Notes

This "communications-centric" view, articulated by Lotus senior vice president of software development and chief technical officer John Landry, involves seeing objects—such as e-mail messages, graphs, and parts of documents and spreadsheets—within the "object store" of Notes.

One way this might work is via future implementation of Chronicle—the code name for a technology Lotus is developing for its 1-2-3 spreadsheet. Chronicle allows users to record alternative scenarios for various ranges of cells. Notes could store these independent views, tracking which user created or modified each. Similarly, a Notes database could store and track the individual contributions to a word-processing document created with an application such as Lotus's Ami Pro. In both cases, the information would become part of a shared database.

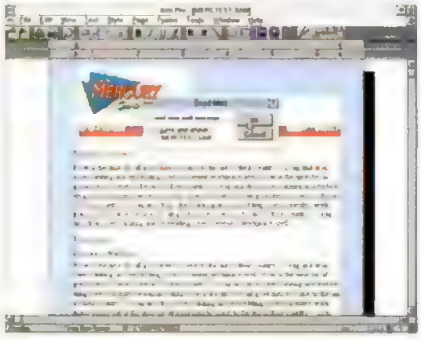
With this strategy, applications such as word processors and spreadsheets could act as editors that get used on appropriate portions of information. Notes was one of the earliest OLE 1.0 containers, but Lotus also has its own internal TOOLS (Technology for Object Oriented Linking & Sharing) to handle shared objects and methods. These include drawing, charting, annotation, mail enabling, and scripting modules, all of which are capable of in-line editing. For now, TOOLS objects use the OLE 1.0 specification, although Landry says Lotus plans to extend TOOLS so that objects can act as OLE 2.0 objects as well. One example of Lotus's in-line editing that already exists is the drawing module within Ami Pro 3.0. When you double-click on a graphics frame, the menu changes to supply appropriate drawing tools.

In a shared-information environment, applications must also be mail-enabled. To this end, Lotus has been one of the primary forces behind the Vendor Independent Messaging (VIM) standard. Irene Greif, Lotus's director of workgroup technologies, says that in addition to standard e-mail, applications will also need their own mailboxes for application-to-application communication.

Lotus also supports VIM because it is integral to the company's cross-platform solution. Notes and other Lotus applications are expected to appear on Windows, NT, OS/2, Macintosh, and Unix. In fact, Lotus sees Notes itself becoming an application environment with published application programming interfaces (APIs) running on top of Noteware, a system software layer that runs in multiple operating environments.

Today, Lotus applications probably look and feel more consistent than those from other vendors. This can be attributed to Lotus's internal Ami Frame Interface Development System (AFIDS), which creates user interface components. For instance, nearly all of Lotus's Windows applications share elements such as SmartIcons and a status bar on the bottom of the screen. Landry says this look will one day be enhanced through innovations such as an InfoBox, a pop-up box that's currently activated with the right mouse button in Improv 2.0 for Windows.

The products will also use a common macro language, called LotusScript, designed as an extension to BASIC. It would replace keystroke macros and provide a single model to manipulate objects. An early version of LotusScript is planned for Improv 2.0, with a more object-oriented version planned for later in the year. Ultimately, all Lotus applications will be able to use LotusScript or other scripting languages.



Mail-Enabling

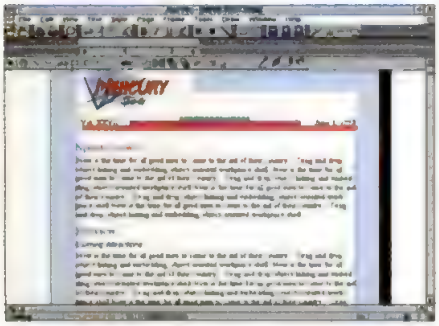
Because applications from a single vendor can be designed to use shared tools and a consistent user interface, Landry believes they will one day work better together. He says users will want a suite of applications such as Lotus's SmartSuite to take advantage of this, adding that vendors who don't offer a suite will mostly sell their applications to other software vendors, who will then resell them to users. Notes becomes the network glue between these applications or editors. □

Many applications have common functions, such as spell checking, charting, drawing, and scripting features. Most major developers are creating common modules to provide these features to all of their applications. This could reduce the number of necessary tools and ensure their consistency.

modules. Their products might share, for instance, a single common charting or spell-checking engine. This would be advantageous for developers because they would only have to develop a single library that works across all of their packages; it would be better for customers because multiple programs from one vendor tend to look and act alike. A single spell-checker across applications also saves considerably on disk space.

Lotus Development Corp. has come up with a variation on this that presents a different approach to OLE. Its word processor, Ami Pro, allows you to place a drawing within your document and edit it using Ami Pro's drawing module, all while still being able to see the complete document. This *in-place* editing allows you to see the surrounding context of what you are editing.

DDE, OLE 1.0, and individual approaches like Ami Pro's are incremental steps toward creating a more document-oriented approach to software. What we really want is a situation that lets us both choose the modules we want from multiple vendors and edit data in the context of its containing document. We also want to be freed from the persistent worry that links will be broken when files move.

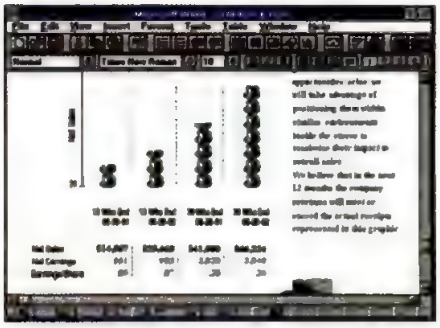


While OLE 1.0 forces you to open a separate window when you edit an inserted object, Lotus's Ami Pro offers in-line editing of drawings. When you click on a drawing, you can access a new toolbar with drawing commands, but you remain within the main word-processing document.

OLE 2.0

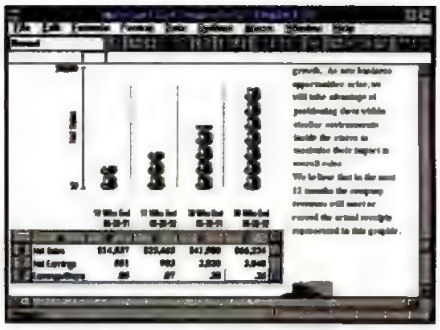
A number of modular, integrated alternatives are now being promoted. The most visible of these is Microsoft Corp.'s OLE 2.0 standard for Windows, which Microsoft developed following discussions with many software vendors.

OLE 2.0 is currently in beta testing and is expected to be released later this year. OLE 2.0 will provide *in-place* activation and editing. Effectively, you'll double-click on an object and receive the basic menus and tools of the application that created it, while still seeing the complete container document.



These demonstration screens, simulating Microsoft Word and Excel, show how OLE 2.0 might let you create a compound document including word-processing, spreadsheet, and graphics components. Note that the menus and toolbars belong to the word-processing document.

In theory, the menus of the two programs would negotiate, so you might have the common File and Edit menus of the container program, as well as specific menus appropriate for the object you are editing. Eventually, a similar process might negotiate the toolbars of the two applications. The implementation of this process is likely to begin with vendors having multiple applications that share interface components.



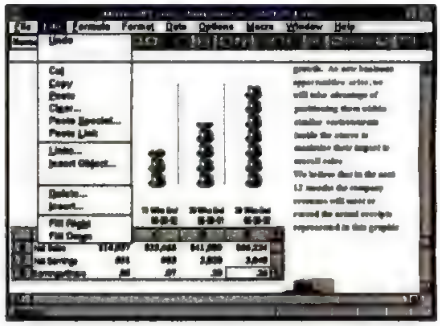
In OLE 2.0, when you select the spreadsheet portion of a document, you can edit the spreadsheet within the compound document. This means you don't have to open up a separate window, as you do in OLE 1.0. Note that it now looks like a spreadsheet and offers the spreadsheet toolbar.

Even with a single vendor providing OLE 2.0, things could be jarring. The original applications menus and most of the tools would disappear. And the precise way that OLE 2.0 will work remains somewhat up to the implementation of each vendor. Microsoft has published guidelines to help smooth the process.

The promise is that you can click on a chart and immediately get your graphing tools, click on a spreadsheet and be inside of your favorite spreadsheet application, and click on text to use your word processor—all without losing the context and flow of your compound document.

OLE 2.0 will also bring drag-and-drop manipulation of objects from one application window to another. For example, you should be able to embed a chart within a spreadsheet and then drag the chart into a word processing window.

Several changes make the 2.0 specifi-



In OLE 2.0, when you are in a word-processing document and open an object created in a spreadsheet, you will get an appropriate spreadsheet menu. Applications will use "menu negotiation" to display these context-appropriate menus.

Rather than tell you how quiet our printer is, we'd like to show you the kind of noise it can generate.

"Many users will be hard pressed to see any difference [from] laser printer pages without resorting to a magnifying glass."

PC Magazine

"...laser-quality text and graphics at about half the cost of the cheapest laser printer."

PC World

"Perhaps most startling is the improvement in output quality. In some cases it is extremely difficult to distinguish from laser printer output."

Marco Boer, Analyst, International Data Corporation

"With the BJ-200 from Canon comes a whole new world of innovation in print quality at a new price point."

C.J. Meiser Jr., Analyst, **BIS Strategic Decisions**

"Excellent print quality... printing speeds faster than comparable competitive models."

Bill Gott, Analyst, InfoCorp

"Best Buy"

Printers Buyer's Guide and Handbook

"The BJ-200 is whisper quiet while printing, which makes it a pleasant neighbor for any computer. Even better, however, is its small footprint."

PC Magazine

The computer industry has spoken, and the message is loud and clear.

To sum it all up, the Canon® Bubble Jet™ 200 desktop printer is super fast, whisper quiet and conveniently compact.

But most importantly, it produces laser quality print at the unheard of price of under $400.*

For more information, or for the name of your nearest Canon dealer, give us a phone call at 1-800-848-4123. We hope to hear from you soon.

Canon

*Dealer prices may vary, but most dealers sell the BJ-200 at prices under $400. PC MAGAZINE quote reprinted from "PC MAGAZINE," December 22, 1992. Copyright ©1992 Ziff Communications Company.

Canon is a registered trademark of Canon Inc. Canon Computer Systems, Inc., 123 E. Paularino Ave., Costa Mesa, CA 92628. For the nearest dealer in Canada, call (800) 387-1241.

Designed To Last. Priced To Go.

Terms. MasterCard, Visa, Discover and American Express accepted. No surcharge for credit card orders. Money orders, certified checks, personal checks accepted (allow ten days for processing). Company and institutional P.O.'s upon credit approval. ZDS resellers and distributors determine their own pricing which may be higher or lower than ZDS' Z*DIRECT price. Prices do not include applicable sales tax, shipping and handling. Government, Education and Volume Purchase buyers please call for a quotation. Federal Government Sales please call 1-800-843-4131. 30-day money-back guarantee applies only when buying through Z*DIRECT. Excludes opened software and purchases which have been subject to abuse. Some models shown with optional accessories. Order by FAX 1-800-472-7211. All products subject to availability. Specification and prices subject to change without notice. Zenith Data Systems is not responsible for typographical or photographic errors. Z*STATION and Z*VISION are trademarks of Zenith Data Systems Corporation. MS-DOS and Microsoft are registered trademarks and Microsoft Windows, Microsoft LAN Manager and Microsoft Windows for Workgroups are trademarks of Microsoft Corporation. i486 and the Intel Inside logo are trademarks of Intel Corporation. Novell and NetWare are registered trademarks of Novell, Inc. Banyan and VINES are registered trademarks of Banyan Systems, Inc. Copyright © 1993 Zenith Data Systems Corporation.

Z▪425SX SAVE $440

i486™SX/25 MHz • 170MB HDD • 3.5" FDD • mouse • 4MB RAM user expandable to 40MB • Super VGA color monitor, 1024 x 768 • MS-DOS® 5.0 and Microsoft® Windows™ 3.1 • one 3.5" and one 5.25" accessible drive bays • serial, parallel, mouse, keyboard, video port • 5 open ISA bus slots • one-year on-site service now included, a $140 value

Z▪433DX SAVE $440

i486DX/33 MHz • 170MB HDD • 3.5" FDD • mouse • 4MB RAM user expandable to 40MB • Super VGA color monitor, 1024 x 768 • MS-DOS 5.0 and Microsoft Windows 3.1 • one 3.5" and one 5.25" accessible drive bays • serial, parallel, mouse, keyboard, video port • 5 open ISA bus slots • one-year on-site service now included, a $140 value

Z▪STATION 433Dh SAVE $300

i486DX/33 MHz • 200MB HDD • 3.5" FDD • mouse • 4MB RAM user expandable to 64MB • Super VGA color monitor, 1024 x 768 • MS-DOS 5.0, Microsoft Windows 3.1 and Microsoft Windows for Workgroups™ • pre-configured network client software for Novell® NetWare®, Microsoft LAN Manager™ and Banyan® VINES® • Ethernet-compatible high speed communication port for LAN connectivity • module sockets for SCSI and WAM (Windows Accelerator Module) • serial, parallel, mouse, keyboard, video port • modular "snap-in" design with 4 ISA slots • one-year limited warranty and on-site service included

Z▪STATION 466Xh

i486DX2/66 MHz • 200MB HDD • 3.5" FDD • mouse • 4MB RAM user expandable to 64MB • Super VGA color monitor, 1024 x 768 • MS-DOS 5.0, Microsoft Windows 3.1 and Microsoft Windows for Workgroups • pre-configured network client software for Novell NetWare, Microsoft LAN Manager and Banyan VINES • Ethernet-compatible high speed communication port for LAN connectivity • module sockets for SCSI and WAM (Windows Accelerator Module) • serial, parallel, mouse, keyboard, video port • modular "snap-in" design with 4 ISA slots • one-year limited warranty and on-site service included

Introducing new Z▪DIRECT pricing, starting at $1449. At Zenith Data Systems, we set new standards for Integrated Connectivity and PC Investment Protection. Now, we pledge you our entire line of high-flying ZDS desktops at rock-bottom prices. Choose our hardworking, expandable Z▪300/400 Series starting at $1449, or our upgradable Z▪STATIONs with built-in networking, pre-installed Windows for Workgroups, top-rated Z▪VISION SVGA color monitors and enviable ergonomic design. For jackpot quality at anybody-can-play prices, call Z▪DIRECT today. Or see your nearest reseller.

intel inside

Call Z▪DIRECT
At 1-800-582-0549.

ZENITH DATA SYSTEMS

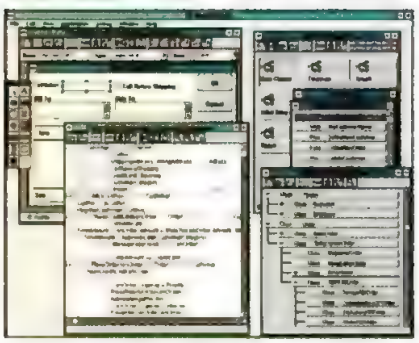
A Bull Company

Thinking Ahead.

COMPANY STRATEGY

Computer Associates International

Because Computer Associates has a large number of applications for mainframe and midrange systems, it tackles applications integration from a slightly different angle. CA talks about "mission-critical" and "line-of-business"



CA-Visual Objects for Clipper

kinds of applications more than other PC vendors do, because these concerns have been the key domain of most larger computer systems.

To promote its strategy, CA has created a comprehensive development plan called CA '90s (Computer Architecture for the '90s), which is designed to take portable components and run them across multiple platforms. A large part of this effort is concentrated on helping customers who are adapting both PC and mainframe applications for use on machines of different sizes.

CA is tying together a variety of development systems that run on multiple platforms through a strategy that includes support for client-server applications, graphical environments, object-oriented programming, and visual development systems. CA emphasizes incremental steps that preserve investments in previous applications.

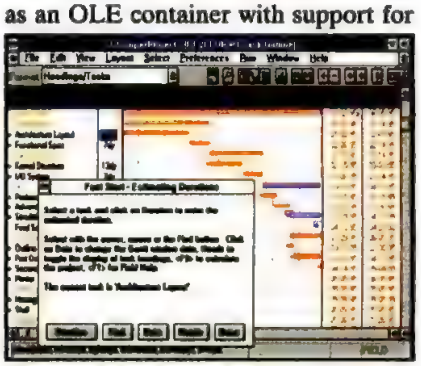
On the development side, CA plans to let developers create a hybrid of traditional procedural code and newer event-driven, object-oriented code. As part of this push, the company plans to extend existing languages via its "Aspen" technology. (Aspen was originally developed by Nantucket Corp. for future versions of Clipper Xbase compiler. CA bought the technology and named the product CA-Visual Objects.) CA-Visual Objects will be available for multiple languages, ranging from Xbase (via CA-dBfast and CA-Clipper) to COBOL to BASIC (via Realizer). Conceptually, this "wrapping" of legacy code within the structure of an object-oriented graphical user interface–based application allows for incremental refinement of existing applications.

In addition, CA wants its different applications to become part of an integrated development environment. For instance, the company's CA-QbyX query system can operate as a standalone application or be used as the query editor in its CA-Visual Objects program. CA plans to make its CA-RET report writer a part of applications such as its CA-Realizer development environment and ACCPAC Simply Accounting for Windows.

Like other companies, CA is planning a macro language designed to be used with multiple applications. CA's CABLE (Computer Associates Basic Language Extended) is a subset of Realizer that doesn't include its forms development capability. "This will turn all applications into application-development systems," says Marc Sokol, director of product strategy. Applications such as the company's CA-Compete spreadsheet and SuperProject will expose their application programming interfaces (APIs) for use by CABLE, Sokol says. CA plans to make CABLE available to other software developers.

On the applications side, CA is working on sharing components and making its applications work together. CA-Cricket Graph is becoming a graphical dynamic link library (DLL) that can be added to other packages, such as Compete. CA will also integrate some of its more targeted products to work with some of the general productivity applications. For instance, it wants to link programs such as CA-SuperProject with specific programs designed to aid application-size estimation (CA-FPXpert), project size and cost estimation (CA-ESTIMACS), and project planning (CA-PLANMACS).

CA has been a little slow to adopt some of the industrywide methods of integration, but work is underway. Realizer, dBfast, SuperProject, and Compete currently support Dynamic Data Exchange (DDE). As yet, no CA products support OLE. Realizer 2.0, due later this year, is scheduled to act as an OLE container with support for



CA-Realizer/CA-SuperProject

OLE 1.0. "OLE 2.0 makes a lot of sense. Today, OLE is still more of a checkbox item than a real useful tool to most customers," Sokol says.

CA will also support a number of standards for tying together database and other services, including Microsoft's Windows Open Services Architecture (WOSA) and Open Database Connectivity (ODBC) standards, and the IDAPI standard being promoted by Borland International and others.

The company has plans to develop its full line of applications for a variety of platforms, including Windows, OS/2, and NT; it also plans to tie together applications on multiple platforms. □

Which One Cost Three Times Less?

Introducing the all new ScanMan® Color.

When computer buff Norris Tadlack couldn't tell which he preferred, output by the leading flatbed scanner or output by ScanMan Color, he whooped, "Gosh darn! I'll buy a color printer with what I'll save with ScanMan!"*

The amazing ScanMan Color handheld scanner includes all these nifty features: 24-bit color...16.8 million colors, plus 256 gray scales... unique Logitech™ AutoStitch for merging up to 4 individual scans automatically... FotoTouch™ Color image editing software for Windows™...this little puppy does it all for less! Pick one up at dealers everywhere. Or call: 1-800-231-7717

LOGITECH
The Senseware™ Company

CIRCLE 182 ON READER SERVICE CARD

*Price comparisons based on SRP's at press date. 8x10 photo was scanned at mfr's recommended settings, without retouching. ™/®–trademarks belong to their registered owners. GSA approved.

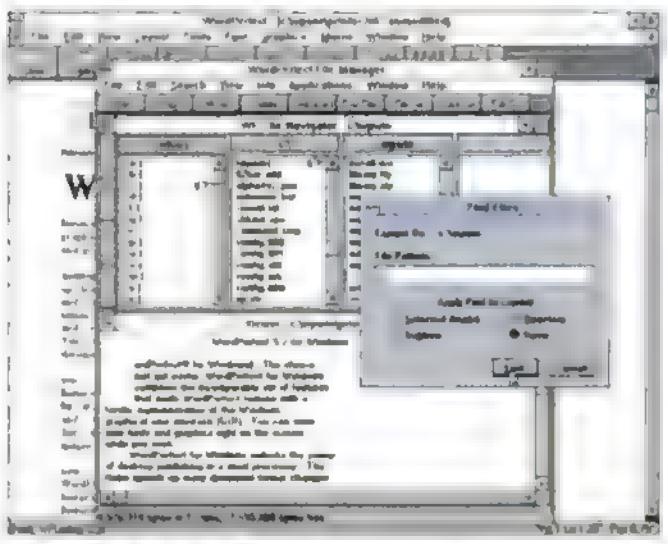
COMPANY STRATEGY

WordPerfect Corp.

You shouldn't be surprised to find that WordPerfect's view of application integration is centered around the document. This view is reflected in the company's suite of products, ranging from its flagship word processor to its still-unreleased forms package called InForms, which allows you to route information and documents over the electronic-mail in the company's new version of its WordPerfect Office. WordPerfect will also be offering a Windows version of WordPerfect Presentations, a business-presentation package, and it just acquired Reference Software, a manufacturer of word-processing tools.

Even though it includes spreadsheet and database products, the WordPerfect suite of offerings is oriented around the document. Mail and the forms package act as the underlying transport system. As part of this strategy, WordPerfect 5.2 for Windows can act as an OLE 1.0 container. The company is committed to working with all major applications via standards such as OLE and Dynamic Data Exchange (DDE). It's also committed to working on multiple platforms.

Although WordPerfect has its own mail product with its own application programming interface (API), the company intends to support Vendor Independent Messaging (VIM) and Messaging Application Programming Interface (MAPI). Already, WordPerfect 5.2 lets users send mail from within the application and receive mail in WordPerfect Mail for Windows or other mail systems such as cc:Mail. Support for Digital Equipment Corp.'s Teamlinks Mail and an IBM PROFS interface are also planned.



WordPerfect for Windows 5.2

Document management is central to the strategy. WordPerfect 5.2's File Navigator includes a file viewer and QuickFinder, a search-and-retrieval tool. You can imagine this technology being extended to the mail system to help you view any document you receive—even if you don't have the application that created it. □

cation more robust than OLE 1.0. There is a new format, DocFiles, which applications will use for storing objects. With this format, compound documents will act as self-contained file systems. This format will serve as the underpinning for the file system in Cairo, the planned object-oriented version of Windows.

As a result, OLE 2.0 should be faster than OLE 1.0; it will let objects remain on-disk until needed, rather than requiring that they get loaded into memory each time the document is opened. It will also allow only portions of objects to be written into memory. OLE 2.0 also has better support for nested objects (objects within other objects). Moreover, it is designed to do a better job of maintaining links when the object file is moved. With OLE 1.0, any movement of object files (to a new directory, for example) resulted in lost links. With OLE 2.0, if you move a container and an object to the same directory, OLE is supposed to maintain those links. But if you move an object separately, the links will still be lost.

OLE 2.0 is also designed to be programmable. It allows applications to "expose" their various commands and functions. Macro languages will be able to use these functions through published application programming interfaces (APIs).

Macro Languages

With a macro language, a macro developed in one program can call other programs' functions. A macro could tell a spreadsheet object inside a word processor that it was time to recalculate or to insert new values into certain cells.

Many large software vendors are working on macro languages that should work across their applications. Microsoft is developing a programming tool that can be used to control OLE-enabled applications. It is also developing Object Basic, planned as a proprietary macro language that will use this feature. Lotus is working on LotusScript, designed to be a common model to manipulate Lotus products as well as a replacement for keystroke macros. Computer Associates is developing the CABLE language (Computer Associates Basic Language Extended), a subset of CA-Realizer (the company's BASIC program), to be added to its major applications.

Some are concerned that Microsoft's own applications group has a head start on other software vendors. Competitors agree that Microsoft is likely to be the first to ship applications that implement OLE 2.0, and its implementation is likely to become a de facto standard. The question is how quickly the others can follow.

The Object-Oriented Desktop

Other environments are also growing more object-oriented. IBM's OS/2 already includes the System Object Model (SOM), which lets programmers create objects that can be used by other objects. SOM is currently being extended to work with multiple programming languages and on multiple systems.

Apple System 7 has an OLE equivalent with Publish and Subscribe, including a feature called Apple Events—a set of external messages that applications can send and reply to. UserLand Software of Menlo Park, California, offers a third-party cross-application language built on Apple Events, and Apple is working on its own cross-application

If you've been thinking PC prices couldn't get any better, ZEOS® has a little surprise for you.

Upgrade from
a desktop to a
vertical case
for only $95!

A. YOUR PERSONAL INFORMATION

Please complete all appropriate sections, *providing at least two years residence and employment history. THIS IS NOT A CREDIT AGREEMENT!* One will be sent to you upon authorization of an account. (This form must be signed to process your application.) All financed purchases are subject to credit approval. *If you have any credit questions, please call 800-421-8942 for assistance.* Thank you!

Name _____

Home Phone (____) _____

Soc. Sec. No. _____ Date of Birth ___ / ___ / ___

Address _____ Apt _____

City _____ State _____ Zip _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____

Previous Address _____

City _____ State _____ Zip _____

Employer _____ Since? (Mo./Yr.) _____

Monthly Gross Salary $ _____ Daytime Bus. Phone (____) _____

Previous Employer _____ From _____ To _____

Occupation _____

A married person may apply for individual credit. I am applying for (please check appropriate box)

☐ **JOINT CREDIT** with another person. Complete entire application

☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application

☐ **INDIVIDUAL CREDIT.** Do not complete section C.**

** If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract

NOTICE TO WISCONSIN APPLICANTS:
YOU MUST DISCLOSE YOUR MARITAL STATUS
☐ married ☐ unmarried ☐ legally separated

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation

Additional Monthly Income $ _____ Source _____

Name & Address of Nearest Relative Not Living With You _____

_____

Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE A

Checking Account ☐ Yes ☐ No
Savings Account ☐ Yes ☐ No

	Y/N	How Many?		Y/N	How Many?
Bank Loan	___	_____	Dept Store Charge Card	___	_____
VISA	___	_____	Credit Union Account	___	_____
MasterCard	___	_____	Other Major Charge Cards	___	_____
Finance Company Loan	___	_____			

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ___ / ___ / ___

Address _____ Apt _____

City _____ State _____ Zip _____

Home Phone (____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (____) _____ Monthly Gross Salary $ _____

CUSTOMER AUTHORIZATION

I authorize ZEOS International, Ltd. or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct to the best of my knowledge and belief

Applicant's Signature _____ Date _____

Joint Applicant's Signature _____ Date _____

FOR MARRIED WISCONSIN APPLICANTS. I acknowledge that the obligation described herein is being incurred in the interest of my marriage or family

Buyer's Signature _____ Date _____

There are costs associated with the use of this credit card. To obtain more information about these costs, call us at 800-421-8942 or write to ZEOS, Z-Card Processing Center, 1301 Industrial Blvd., Minneapolis, MN 55413.

NY–A consumer credit report may be requested in connection with this application or in connection with updates, renewals or extensions of any credit granted as a result of this application. If I subsequently ask for this information, I will be informed whether or not such a report was requested and, if so, the name and address of the agency that furnished the report

OH–The Ohio laws against discrimination require that all creditors make credit equally available to all creditworthy customers and that credit reporting agencies maintain separate credit histories on each individual upon request. The Ohio Civil Rights Commission administers compliance with this law

*Financing not available in Alaska, Hawaii or outside the continental U.S

ZCD-PCM-9303B

Z-CARD PRIORITY APPLICATION FAX NUMBER: 612-633-7507

CIRCLE 115 ON READER SERVICE CARD

Apply for your own Z·Card℠ today!

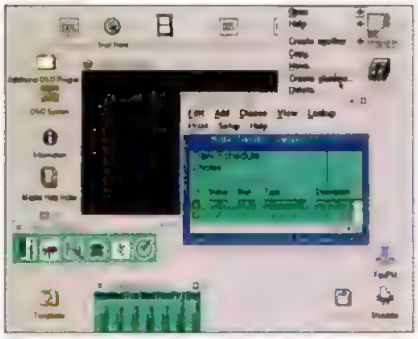
Here's another great reason to buy a ZEOS system: the Z-Card℠! The Z-Card works just like a MasterCard or VISA–so you can charge your ZEOS purchases and pay in easy monthly installments. And since no down payment is required, it makes buying your new ZEOS system easier than ever!

You can apply for your very own Z-Card and low, low monthly payments right now. Simply fill out this application and fax it to 612-633-7507. Or mail it to ZEOS *International, Z-Card Processing Center, 1301 Industrial Blvd., Minneapolis, MN 55413*. We'll contact you as soon as your credit line is established, usually within 24 hours of receipt. Apply today!

COMPANY STRATEGY

IBM

IBM positions OS/2 as the "integrating environment," which allows you to run applications created for DOS, Windows, and OS/2. But OS/2 also has a variety of features that help integrate these applications. The most visible example is the Workplace Shell user interface. It allows for object-oriented applications and supports actions such as dragging information between applications.



Workplace Shell has object-oriented features.

According to Cliff Reeves, IBM's manager of object technology products, Workplace Shell is based on IBM's System Object Model (SOM), which allows programmers to create objects that become part of the system. SOM is the backbone of the interapplication communications and drag-and-drop features. Applications designed for SOM can share a common printer or shredder icon or they can extend the file-management features built into the operating system.

John Soyring, director of software development programs for IBM Personal Software Products, points to the OS/2-based DeScribe and cc:Mail as applications that use SOM to integrate themselves with the Workplace Shell. Essentially, cc:Mail for OS/2 consists of three large SOM objects: an inbox, an outbox, and a directory listing. These objects work with each other and can be used by other SOM applications.

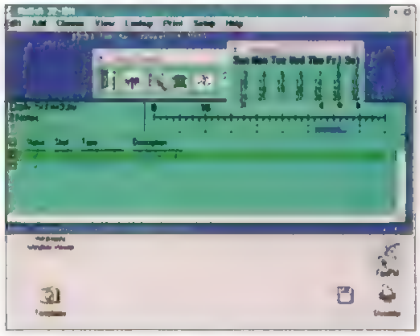
Other examples include Relish, a Workplace Shell–based calendar from Sundial Systems (Seal Beach, California). Relish lets you print by dragging the date to the desktop printer icon. Other SOM-based designs, such as those of mortgage loan analysis tools from Footprint Software (Toronto, Canada),offer more vertical market functionality. While the number of SOM-based applications is relatively small today (even the applets that come with OS/2 do not support it), Soyring expects that number to increase as OS/2 compiler support increases. Today, SOM is supported commercially only in C; IBM is working with compiler vendors to make it possible to write SOM-compliant applications in C++, COBOL, and Smalltalk.

OS/2 supports a variety of other standards that can be used across applications that were designed to run on different platforms. For example, you can use a common clipboard to cut and paste, cutting from a DOS application and pasting into a Windows or OS/2 application. Or you can paste Windows or OS/2 information into DOS applications, although most DOS programs can only accept text.

Dynamic Data Exchange (DDE) works almost identically under OS/2 as it does under Windows, but you can use it between Windows and OS/2 applications. Windows applications that come with the OLE libraries can integrate data while running under OS/2. OLE 1.0 support is part of the Windows 3.1 support that IBM is adding to its upcoming OS/2 2.1. Though OLE support is not part of OS/2 applications per se, Soyring says Windows applications are only now catching up to the drag-and-drop and seamless integration features that are part of SOM.

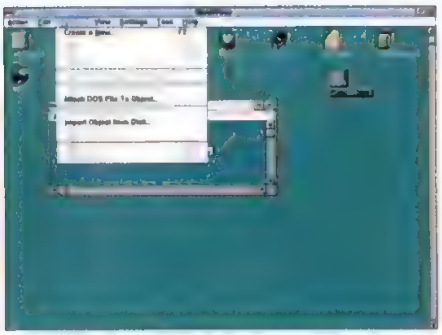
IBM's strategy is to incorporate more object-oriented and applications-integration features into future versions of the operating system. The next major step is a microkernel-based Workplace Operating System. Larry Loucks, IBM Fellow and director of software architecture, says this system will be based on the Mach microkernel, with multiple "personality modules"—such as AIX and OS/2—on top of it. IBM will later introduce a more object-oriented Taligent System, the result of a joint venture with Apple Computer.

SOM enhancements, including a version called Distributed SOM (DSOM), should allow objects to be shared with other machines via a network. DSOM is designed to be location- and language-independent. Versions of DSOM for AIX and OS/2 are being readied now, with versions for other platforms being planned. These support Object Management Group's CORBA standard for managing objects across platforms and machines. Ultimately, this would bring a true integration to different classes of machines—from laptops to PCs to workstations, minicomputers, and mainframes—thus tying together more of IBM's products.



With SOM, applications can be further integrated.

OS/2 already includes REXX, a cross-application macro language found on other IBM systems as well. Visual programming tools and object-oriented extensions to REXX will make it a powerful cross-platform solution for linking applications. □



Eventually, most developers look forward to an object-oriented desktop. Some products, such as Hewlett-Packard's NewWave (above), which sits on top of Windows 3.1, add object-oriented features to existing environments. NewWave uses agents to complete interapplications tasks.

macro language, Apple Script. It has also announced support for its own object-oriented file format, Bento, and plans for a larger, more object-oriented solution—Apple Open Collaborative Environment (AOCE). A Windows version of Apple's Bento and a Mac version of OLE (from Microsoft) are on the way.

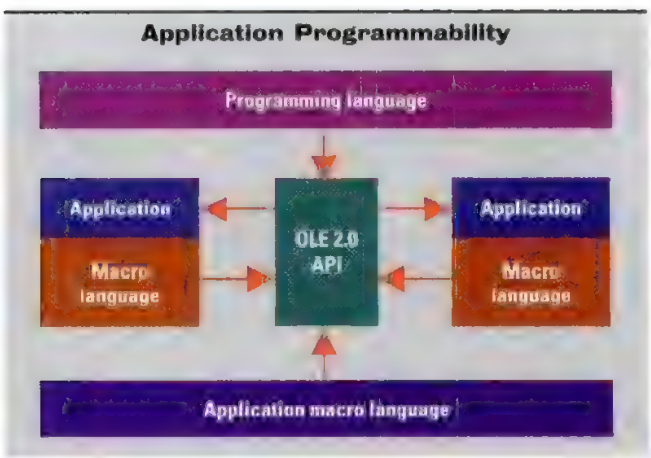
The evolution is toward an object-oriented world where both the applications and the operating system are object-oriented. Down the road, you might not buy a new application. Instead, you would install a new tool, which could be used in conjunction with your other tools.

There are already several examples of what this object-oriented world might look like, such as NextStep and other Unix-based solutions. GO Corp.'s Penpoint system uses a notebook metaphor where tools can be mixed and matched across applications. Hewlett-Packard's NewWave environment brings some of these features to the Windows desktop, including an agent facility for programming integrated applications. Other systems under development include Taligent, the joint venture of Apple and IBM.

The Future Is Document-Centric

Microsoft's vision includes an object-oriented version of Windows called Cairo. Cairo is designed to build on the OLE 2.0 specification and the Windows Open Services Architecture (WOSA), with new 32-bit APIs added; it will include a new user interface and a more advanced object model that is expected to combine directory, mail, and object storage. Central to this system is a file system that will let you search and retrieve objects based on both their contents and their properties. Microsoft expects to show Cairo publicly in the fall, although the product is not planned for introduction until late 1994.

Regardless of whether tomorrow's leader is Cairo or another object-oriented operating system, most industry observers believe that we are moving toward integration built around reusable components that act as tools you can use in any document. In part, the movement is fueled by the fact that every year, we expect more and more out of our applications. Vendors wanting to comply with our wishes find that they can add more features if they use reusable components. This allows them to break down their applications into smaller, more numerous pieces and create applications out of reusable components. Customers gain the freedom to assemble pieces of software into solutions that fit their particular needs.



Applications will be able to "expose" their features via an interface such as OLE 2.0. This will let general programming languages and macro languages within a program control other programs.

Alex Morrow, who is Lotus Development Corp.'s general manager of cross-product architecture, believes that in about two years customers will want to start buying components. He predicts that people will have a small number of very general tools, such as a text editor, spreadsheet cell engine, and chart tool, as well as a large number of special-purpose tools. This will allow us to move from a view of computing that is centered on applications to one that is centered on tools and documents.

In this kind of environment, you are still likely to start a document by choosing a template that contains the document semantics, says Microsoft executive vice president Mike Maples. Document semantics are important because different kinds of documents organize pages differently. With word processing documents, pages tend to flow. In database report writers, page breaks often depend on the data itself. In presentations, pages tend to be fixed.

You'll be able to mix and match products to make your environment work the way you want it to work.

After choosing the main document environment, you'll be able to add all sorts of tools. There will probably be more tools designed to replace those in traditional applications—more tools intended for special purposes. We are also likely to see more written specifically for individual businesses. You'll be able to mix and match products to make your environment work the way you want it to work.

There's a long way to go—and many obstacles to overcome—before this becomes a reality. The specifications and standards still have to be completed, and the operating environments and applications themselves need to be written or rewritten. But object orientation promises to change the way we use computers, making application integration not just a welcome feature but a basic way of computing.

Navigating Applications Integration

Making programs work together is easier with the information in these charts.

by Joseph Desposito

The first chart, "DDE, OLE, and E-Mail Access," contains information on the DDE and OLE capabilities of nine popular Windows programs, specifying whether they act as clients or servers in the DDE and OLE environments. The chart also indicates which of four electronic-mail packages are compatible with each program. (A yes answer implies menu access to the specified kind of e-mail.)

The multipage chart that follows, "How to Make Applications Work Together," indicates the primary ways one application (in the left-hand column) can integrate data from another (in the top row of the chart): by means of a Direct Read, Direct Data Access, a File Import, the Windows Clipboard, Object Linking, or Object Embedding. A Read involves calling up a file, while Direct Access means examining file contents without bringing them into the application. Import involves a translation of file formats. Wherever Linking or Embedding is an option, the first columns indicate which commands the application uses to support the process.

Note that all the listed products can import ASCII files, and many can export data to file formats other than their own. Also, many vendors have developed macro languages or other hooks to external programming languages that allow various degrees of integration. □

DDE, OLE, and E-Mail Access

■—YES □—NO	DDE		OLE		E-MAIL ACCESS			
	Client	Server	Container (client)	Object (server)	cc:Mail	Lotus Notes	Microsoft Mail	WordPerfect Office
Ami Pro 3.0 for Windows	■	■	■	■	■	■	□	□
Microsoft Word for Windows, Version 2.0	■	■	■	■	□	□	■	□
WordPerfect 5.2 for Windows	■	■	■	□	■	□	■	■
Lotus 1-2-3 for Windows, Release 1.2	■	■	□	□	■	■	□	□
Microsoft Excel 4.0 for Windows	■	■	■	■	□	□	■	□
Quattro Pro for Windows, Version 1.0	■	■	■	□	□	□	□	□
Freelance Graphics for Windows, Release 2.0	■	■	■	■	■	■	□	□
Harvard Graphics for Windows, Version 1.03	■	□	□	□	□	□	□	□
Microsoft PowerPoint for Windows, Version 3.0	□	□	■	■	□	□	■	□

All data in these charts is based on *PC Magazine* research and vendors' reports.

WHAT'S THE DIFFERENCE BETWEEN THESE TWO G's?

infiniType™ Volume 1
50 TYPEFACES
$49.95 suggested retail price

One of the characters shown above is from a large well-known type vendor. The other is from infiniType Volume 1. If you can't see a difference in quality, don't worry...there isn't one. But if you don't see a difference in value, you should have your eyes checked. Each infiniType volume contains fifty professional quality faces for under $50–provided in both PostScript Type 1 and TrueType formats– compatible with infiniType Plus™, Microsoft Windows, OS/2 and other applications that support PostScript or TrueType. Our advanced package, infiniType Plus, offers even more–124 faces plus a scaling engine.

infiniType...take a close look and you'll see. The only real difference is the price.

Ask your local software retailer, or call us for a dealer in your area.

1-800-346-5764.

Columbus AURELIUS OPEN Sans
SHOTGUN ENTEBBE Egyptian
STENCIL Stafford *Legend* QUARTZ
Verona Sunset Dragon Grenoble

*infin***Type**™

SoftMaker

2195 Faraday Ave.
Suite A
Carlsbad, CA 92008
619-929-6030

CIRCLE 212 ON READER SERVICE CARD

How to Make Applications Work Together

DATA INTO:	OLE COMMANDS		DATA FROM: WORD PROCESSORS				
	Linking commands	Embedding commands	Ami Pro 3.0 for Windows	Microsoft Word, Version 5.x	Microsoft Word for Windows, Version 2.0	WordPerfect, Version 5.1	
WORD PROCESSORS							
Ami Pro 3.0 for Windows* (Lotus Development Corp.)	Edit/Paste Link	Edit/Insert		Import	Import, Clipboard, Linking, Embedding	Import	
Microsoft Word, Version 5.x (Microsoft Corp.)			Clipboard		Import, Clipboard	Import	
Microsoft Word for Windows, Version 2.0 (Microsoft Corp.)	Edit/Paste Special/Paste Link	Insert/Object	Clipboard, Linking, Embedding	Import		Import	
WordPerfect, Version 5.1 (WordPerfect Corp.)				Import			
WordPerfect 5.2 for Windows (WordPerfect Corp.)	Edit/Paste Link	Edit/Insert Object	Import, Clipboard, Linking, Embedding	Import	Import, Clipboard, Linking, Embedding	Read	
SPREADSHEETS							
Lotus 1-2-3 for DOS, Release 2.4 (Lotus Development Corp.)							
Lotus 1-2-3 for DOS, Release 3.4 (Lotus Development Corp.)							
Lotus 1-2-3 for Windows, Release 1.1 (Lotus Development Corp.)			Clipboard		Clipboard		
Microsoft Excel 4.0 for Windows (Microsoft Corp.)	Edit/Paste Link	Edit/Insert Object	Clipboard, Linking, Embedding		Clipboard, Linking, Embedding		
Quattro Pro 4.0 for DOS (Borland Corp.)							
Quattro Pro for Windows, Version 1.0 (Borland Corp.)	Edit/Insert Object	Edit/Paste Format	Clipboard, Linking, Embedding		Clipboard, Linking, Embedding		
PRESENTATION GRAPHICS							
Freelance Graphics for Windows, Release 2.0 (Lotus Development Corp.)	Graph/Import (Link)	Edit/Paste Link	Clipboard, Linking, Embedding		Clipboard, Linking, Embedding		
Harvard Graphics, Version 3.0 (Software Publishing Corp.)							
Harvard Graphics for Windows, Version 1.03 (Software Publishing Corp.)			Clipboard		Clipboard		
Microsoft PowerPoint for Windows, Version 3.0 (Microsoft Corp.)	Edit/Paste Special	Edit/Insert	Clipboard		Read, Import, Clipboard, Linking, Embedding		

* In Ami Pro, objects can be embedded only in frames

CONTINUES

SPREADSHEETS							
WordPerfect 5.2 for Windows	**Lotus 1-2-3 for DOS, Release 2.4**	**Lotus 1-2-3 for DOS, Release 3.4**	**Lotus 1-2-3 for Windows, Release 1.1**	**Microsoft Excel 3.0 for Windows**	**Microsoft Excel 4.0 for Windows**	**Quattro Pro 4.0 for DOS**	**Quattro Pro for Windows, Version 1.0**
Import, Clipboard, Linking, Embedding	Import (.WK1, .FMT)	Import (.WK3, .FM3)	Import, Clipboard, Linking, Embedding	Import, Clipboard, Linking, Embedding	Import, Clipboard, Linking, Embedding		Clipboard, Linking, Embedding
Import, Clipboard	Import (.WK1)	Import (.WK3)	Clipboard	Import, Clipboard	Clipboard		Clipboard
Import, Clipboard, Linking	Import (.WK1)	Import (.WK3)	Import, Clipboard, Linking	Import, Clipboard, Linking, Embedding	Import, Clipboard, Linking, Embedding		Clipboard, Linking, Embedding
Read, Import	Import (.WK1, .FMT)	Import (.WK3, .FM3)	Import	Import	Import	Import	
	Read (.WK1), Import (.WK1)	Read (.WK3), Import (.WK3)	Read, Import, Clipboard	Read, Import, Clipboard, Linking, Embedding	Clipboard, Linking, Embedding	Read, Import	Clipboard
		Import (WK3, .FM3)	Import				
	Read (.WK1, FMT)		Read				
Clipboard	Read (WK1, .FMT)	Read (WK3, FM3)		Import, Clipboard	Clipboard		Clipboard
Clipboard, Linking	Read (.WK1, .FMT)	Read (.WK3, .FM3)	Read, Clipboard, Linking	Read, Clipboard, Linking, Embedding			Clipboard, Linking
	Read (.WK1), Import (.WK1, .FMT)	Import (WK3, FM3)	Read, Import				
Clipboard	Read (.WK1, .FMT), Import (.WK1, .FMT)	Read (.WK3, .FM3)	Read, Import, Clipboard, Linking	Read, Import, Clipboard, Linking, Embedding	Read, Import, Clipboard, Linking, Embedding	Read, Import	
Clipboard, Linking, Embedding	Read (.WK1)	Read (.WK3)	Read, Clipboard, Linking, Embedding	Read, Clipboard, Linking, Embedding	Read, Clipboard, Linking, Embedding		Clipboard, Linking, Embedding
	Import (.WK1)	Import (WK3)	Import	Import	Import		
Clipboard	Import (WK1)	Import (.WK3)	Import, Clipboard	Import, Clipboard	Import, Clipboard		Clipboard
Clipboard	Import (.WK1)	Import (.WK3)	Clipboard	Read, Import, Clipboard, Linking, Embedding	Read, Import, Clipboard, Linking, Embedding		Clipboard

DATA INTO:	DATA FROM: DATABASE SOFTWARE			
	dBASE IV, Version 1.x	**Paradox, Version 3.5**	**Paradox, Version 4.0**	**Freelance Graphics for Windows, Release 2.0**
WORD PROCESSORS				
Ami Pro 3.0 for Windows* (Lotus Development Corp.)	Import	Import		Import, Clipboard, Linking, Embedding
Microsoft Word, Version 5.x (Microsoft Corp.)				
Microsoft Word for Windows, Version 2.0 (Microsoft Corp.)	Import			Clipboard, Linking, Embedding
WordPerfect, Version 5.1 (WordPerfect Corp.)				
WordPerfect 5.2 for Windows (WordPerfect Corp.)				Clipboard
SPREADSHEETS				
Lotus 1-2-3 for DOS, Release 2.4 (Lotus Development Corp.)	Import			
Lotus 1-2-3 for DOS, Release 3.4 (Lotus Development Corp.)	Direct access, Import	Direct access		
Lotus 1-2-3 for Windows, Release 1.1 (Lotus Development Corp.)	Direct access, Import	Direct access, Import		Clipboard
Microsoft Excel 4.0 for Windows (Microsoft Corp.)	Direct access, Import			Clipboard, Linking, Embedding
Quattro Pro 4.0 for DOS (Borland Corp.)	Read, Import	Read, Import	Read, Import	
Quattro Pro for Windows, Version 1.0 (Borland Corp.)	Direct access, Import	Direct access, Import	Direct access, Linking, Import	Clipboard, Linking, Embedding
PRESENTATION GRAPHICS				
Freelance Graphics for Windows, Release 2.0 (Lotus Development Corp.)	Direct access			
Harvard Graphics, Version 3.0 (Software Publishing Corp.)	Import			
Harvard Graphics for Windows, Version 1.03 (Software Publishing Corp.)				
Microsoft PowerPoint for Windows, Version 3.0 (Microsoft Corp.)				Clipboard, Linking, Embedding

*In AmiPro objects can be embedded only in frames

ENDS

PRESENTATION GRAPHICS			GRAPHICS FILE FORMATS				
Harvard Graphics, Version 3.0	**Harvard Graphics for Windows, Version 1.03**	**Microsoft PowerPoint for Windows, Version 3.0**	**.CGM**	**.EPS**	**.PCX**	**TIFF**	**.WMF**
	Clipboard, Linking, Embedding	Clipboard, Linking, Embedding	Import	Import	Import	Import	Import
Import	Clipboard	Clipboard		Import	Import	Import	
Import	Import, Clipboard	Clipboard, Linking, Embedding	Import	Import	Import	Import	Import
			Import	Import	Import	Import	Import
	Clipboard	Clipboard, Linking, Embedding	Import	Import	Import	Import	Import
			Import				
			Import				
	Clipboard	Clipboard	Import				
	Clipboard, Linking	Clipboard, Linking, Embedding					
Read			Import				
	Clipboard	Clipboard	Import	Import	Import	Import	
Import	Clipboard, Linking, Embedding	Clipboard, Linking, Embedding	Import	Import	Import	Import	Import
	Read		Import		Import	Import	
Read, Import			Import		Import	Import	Import
	Clipboard, Linking, Embedding		Import	Import	Import	Import	Import

PORTABLE PCs

The Laptop Gap

While computer makers squeeze more desktop features into their notebooks and enhance battery life, buyers are demanding even more. We test 31 mobile powerhouses.

by Bill Howard

Always has been. Always will be. The gap between the features and performance of portable and desktop computers widens and closes, but it never goes away. Sometimes desktops pull away. Sometimes laptops draw closer. Right now, the best portable PCs have narrowed the gap—somewhat.

In this review, PC Magazine Labs takes a look at 31 notebook systems introduced since last fall's Comdex computer show. While none runs at the top 66-MHz speed of the fastest desktop systems, two-thirds of the reviewed notebooks are based on some variant of the Cyrix, IBM, or Intel 486 chips. Three systems have clock-doubled 50-MHz CPUs, just one clock-speed increment removed from the top. And, one unit is based on Intel's low-voltage 486SL/25 CPU, which has been designed for the rigors of life on the road. More on that development later.

Every one of the 31 systems here is capable of

Photograph by David Arky

running Microsoft Windows and has hard disks that are capable of storing the huge program and data files associated with Windows. Clearly, some notebooks do Windows more efficiently than others. And the ones that do it best are, not very surprisingly, the bulkier, heavier, and more expensive systems, such as the Compaq LTE Lite/25E, the IBM ThinkPad 700C, the Toshiba T4400C, and the Compaq LTE Lite 4/25C.

The extent to which notebook makers recognize the importance of Windows is demonstrated by the components found in these notebooks:

- Twelve had color screens; another, the AST PowerExec 3/25SL has a color option, although we did not receive it in time to test it; and one Compaq model, the LTE Lite/25E, offers a dazzling active-matrix monochrome display that is still without equal in the world of liquid crystal technology;
- Almost every vendor offers at least a 120MB hard drive, and ten offer capacities of 200MB or greater;
- Twenty-two machines had some sort of internal pointing device; the majority of them had built-in trackballs.

Even users who don't want or need Windows benefit from the intense competition that forces down the price of perfectly adequate DOS-oriented notebook systems to $1,500 or less. Many 386-based systems with at least a 60MB drive and 2MB RAM cost less than $2,000.

WHAT'S NEW, WHO'S HOT

The major vendors that have aggressive, desirable products in this review include AST, Compaq, IBM, and Texas Instruments. The latest models from other major-label makers such as NEC, Toshiba, and Zenith Data Systems have either been out for a few months and have been reviewed already, or they were shipped after our deadline and will be included in our next review, in August, 1993.

AST's solid but aging Premium Exec line has been superseded by the slimmer, svelter, 6.2-pound AST PowerExec 3/25SL, available with one of three screens: monochrome, passive color, or active-matrix color. The PowerExec's hard disk is removable and can be used with a drive bay attachment in desktop PCs. There's also an extensive security system that includes a key-based interlock, an optional Zenith-style port replicator, and a snap-on front-mounted trackball.

Digital Equipment Corp. sells a relabeled version of the PowerExec as the DECpc 325SL, which was not available in time for a full review, but we were able to use one for a few weeks, and we found it to be an overall solid unit with good battery life. The one negative point was the unit's suspend-and-resume function, which sometimes didn't respond.

Compaq has three machines that we reviewed: the first Intel 486SL-based active-matrix color system, the LTE Lite 4/25C; the first PC-based active-matrix monochrome system, the LTE Lite/25E, with an enhanced version of the Hosiden Corp. display panel used previously in the Apple PowerBook; and the value-line Compaq Contura 3/25C, with a passive-matrix color display.

IBM's portables used to be good for a laugh. Now they're just good, period. Particularly the $4,825 matte black, 7.6-pound ThinkPad 700C with its dazzling 10.4-inch active-matrix color display, which is similar to the screen on the bulky, AC-only Toshiba T6400 luggable. Both displays come from Display Technologies Inc. (DTI), the IBM-Toshiba joint venture. But the most talked-about feature is TrackPoint II, a stubby little pointing device that looks like a pencil eraser jutting up between the G and H keys. Press it in the direction you want the cursor to go. The harder you press, the faster the cursor moves.

IBM also offers a monochrome version, the IBM ThinkPad 700, for $2,950. While ThinkPad was first used last year as the name for its tablet computer (see the sidebar "State of the Slate"), IBM now uses the ThinkPad appellation for its entire line of portables. The other IBM system in this review, the ThinkPad 300, is a more conventional notebook PC, although it includes a built-in Ethernet connection. If Ethernet sounds unusual from the company that invented Token-Ring networking, it's because the 300 is really a ZDS notebook in disguise.

With its TI TravelMate 4000 WinDX2/50, Texas Instruments takes a leadership role with near-desktop performance and true portability, with the machine weighing-in at 4.4 pounds (without its AC adapter). The monochrome TI system, based on Intel's 486DX2/50 CPU (one of the three DX2/50s in the review, along with the Ergo Nifty Fifty 486/50 Color NoteBrick system and the BSI

IN THIS REVIEW

Aspen Personal 486.....153
AST PowerExec 3/25SL.....160
BCC Avanti 486/V32 Model 200.....166
BSI NB486DX2-50.....166
CAF AquaLITE-II.....173
Compaq Contura 3/25C.....173
Compaq LTE Lite 4/25C.....174
Compaq LTE Lite/25E.....176
CompuAdd 425C.....176
Ergo Modular Color 486SLC NoteBrick.....182
Ergo Modular 486SLC NoteBrick.....182
Ergo Nifty Fifty 486/50 Color NoteBrick.....187
Expo Note 33.....187
GRiD 1660C.....188
Hyundai Courier Spectra.....188
IBM ThinkPad 300.....191
IBM ThinkPad 700.....191
IBM ThinkPad 700C.....191
Northgate ZXPortable Active Color.196
Northgate ZXPortable 486DX/25.....196
PC Brand 486/SLC Color LeaderBook.....176
Poly NB433DX.....197
Sharp PC-6881.....200
Sharp PC-7750.....200
Swan 486/SLC-25 Notebook.....201
Tenex Notebook 386DXL/33.....202
TI TravelMate 4000 WinDX2/50.....207
TI TravelMate WinSLC.....207
Toshiba T4400C.....216
Transource Verxion NB8004.....217
U.S. Professional Notebook 486DX..218

Our Contributors: BILL HOWARD is an executive editor and CHRISTOPHER BARR is a senior editor of *PC Magazine*. BRIAN NADEL was the associate editor in charge of this story, and JONATHAN HILL was the project leader. OLIVER RIST is a staff writer, CAMILLE N. CLINE and ANUSH YEGYAZARIAN are editorial researchers, and TIN ALBANO is an editorial assistant. BRUCE BROWN is a contributing editor to *PC Magazine*. PETER LEWIS is a free-lance writer and covers computers for *The New York Times*. MICHAEL BONOMO and ANDREW COLLIER are also free-lance writers.

NB486DX2-50), was first or second in virtually all of our performance tests. With a Battery Rundown score of more than three hours, the TI system fared well in battery life tests, and, due to its unique power-conservation system that shuts down the CPU between keystrokes, it didn't heat up either. Our day-to-day experience with TI systems (and the essentially similar TI-engineered systems sold by Gateway 2000) over the past year has shown that they hold up well.

PARITY FOR HAVE-NOTS

Just as the gap between desktop and laptop has been bridged somewhat, so has the gap between the haves and the have-nots of the portable computer industry—measured in quality, portability, power, and desirability. No longer will you see a rickety 10-pound no-name 286-powered laptop lacking a modem slot, with a transformer the size and heft of a wrecker's ball, trying to go one-on-one in the marketplace with a 7-pound Toshiba or NEC notebook.

Typically, the size and weight disparity today, if there is one, is no more than a fraction of an inch, a fraction of a pound, or a fraction of an hour of battery life. For this survey of 31 notebook systems, we found that the typical machine including battery and charger weighed 7.9 pounds, had a battery life of 2 hours 15 minutes, and cost $2,890.

In part, this progress is a result of the law of natural selection among computer vendors, which forced some of the lesser lights of the industry out of business by the end of 1992. Call it the result of computational Darwinism, but those companies that survived the shakeout have done so with the help of competent third-party vendors of system BIOSes, chip sets, and video circuitry such as Cirrus Logic, Headland, Intel, Phoenix Technologies, and Western Digital.

At the same time, the industry is still far from true parity. The majority of the innovations in portable computing tend to come first from the name players with the biggest R&D budgets—and that's not liable to change anytime soon.

NOTABLE FEATURES

The majority of reviewed systems have some form of pointing device, although in our opinion none matches up to the quality of the massive trackball on the Apple Macintosh PowerBook (see the sidebar "Double-Duty Duo"). In Apple's case, you're always running in a graphical mode, so it doesn't make sense to have a half-hearted pointing device. We suspect most portable users want to use the built-in devices on the road, and connect a mouse back in the office.

Our features table notes whether the pointing device is built-in (such as a mini-

HIGHLIGHTS

Portable PCs

THE NEXT STEP in portable processing power, Intel's 486SL chip, appeared in one reviewed system: the Compaq LTE Lite 4/25C. Because of the 486SL's hardware power conservation, Compaq was able to trim the system's weight by using lighter batteries, yet the Lite 4/25C has an acceptable battery life despite its power-hungry active-matrix color screen.

THE BEST PORTABLES have just about caught up with standard desktop systems in terms of performance. The TI TravelMate 4000 WinDX2/50 stands alone in delivering near-desktop processor performance, though it lags a bit in DOS video.

THE AVERAGE PORTABLE PC in this 31-product roundup had a 7.9-pound weight (including a battery charger), a Battery Rundown time of 2 hours 15 minutes, and cost $2,890.

ALL 31 SYSTEMS are capable of running Microsoft Windows, but some do it better than others. Twelve of the systems had color screens; impressive Windows performers include the Compaq LTE Lite 4/25C, IBM ThinkPad 700C, and Toshiba T4400C.

INTEGRATED POINTING DEVICES, most of them built-in trackballs, appeared on 22 systems. Unique among them was IBM's TrackPoint II, a stubby eraser-like device that sits between the G and H keys: The harder you press, the faster the on-screen movement.

POINTING DEVICE STYLES varied greatly: We saw integrated models (mini-trackballs or IBM's TrackPoint II), clip-ons (cord-based models, like the Microsoft BallPoint), snap-ons (with a cordless connection), and free-standing models (external mice). Several vendors included a software mouse that you activate by pressing keys.

PCMCIA slots appeared on three machines. There are few PCMCIA-slot products, and several modems and flash memory cards have started shipping. Expect to see the true beginning of this technology later this year.

INTEL CPUs, found in 52 percent of the systems, dominated this group, but nine processors came from Cyrix, four from AMD, and two from IBM.

DISCOUNTS are becoming more erratic. Typical price breaks ranged from 5 to 36 percent, depending on the model and choice of outlet.

APPLE'S DUO SUBNOTEBOOK is a step forward in portable computing technology. Weighing 4.2 pounds, the PowerBook Duo 230 uses a Motorola 33-MHz CPU and has Apple's famous front-mounted trackball. The Duo Dock transforms this portable into a versatile desktop PC.

SECOND-GENERATION pen-based systems, like the NEC UltraLite Autograph, are much better than their predecessors; still, they are fairly limited and will be used only in vertical applications, like forms filling.

EDITORS' CHOICE

- **Monochrome:**
  Compaq LTE Lite/25E
  TI TravelMate 4000 WinDX2/50
- **Color:**
  Compaq LTE Lite 4/25C

When you strip away all the hype and unreasonable claims about weight, screen quality, and battery life, the essence of a portable computer boils down to an acceptable compromise between power and portability. In this roundup of the computer industry's newest notebooks, we saw vendors augmenting their lines with innovative features such as PCMCIA slots (AST Research, Compaq, and Sharp), a key-based security system (AST), and peerless color displays (IBM, Toshiba, and Compaq). The Editors' Choices for this review go beyond delivering one or two new or interesting items to integrating power and usability into an eminently portable package.

ALL-AROUND PERFORMERS

Of Texas Instruments' TI TravelMate twins, the system powered by Intel's 50-MHz 486DX2 CPU stands out based on its near-desktop performance. In almost a clean-sweep, the TravelMate took top performance honors on four of seven benchmark test suites, and lagged in none. Still, the TI TravelMate achieved sensational battery life times of greater than three hours due to its unique internal power-management system that shuts down computing between keystrokes. In a rarity that demonstrates the system's ability to please prospective users, the TravelMate rated all fours on our Suitability to Task measure—the equivalent of straight As. Our only criticisms revolve around the system's near-$4,000 price.

In a return engagement, the Compaq LTE Lite/25E continues to win rave reviews based on its innovative monochrome active-matrix screen, and all-around solid performance. First-time viewers are usually amazed at its display, likening it to a black-and-white television screen. The Lite/25E sits near the center of both the price and performance ranges for this test, making it the technological value choice. But, its design really demands a more powerful 486-level CPU.

COLORFUL CONTENDER

The Compaq LTE Lite 4/25C is a machine of firsts: the first 486SL processor in our tests, among the first portables with PCMCIA slots, and the first of a new generation of sub-seven-pound color portables. Its light weight was not at the expense of battery power (it lasted more than two hours on the Battery Rundown test), nor is the 4/25C a 98-pound weakling of the notebook world, scoring at or well-above average on all benchmark test suites. Add to that a 14,400-bps internal modem and an upcoming cellular phone interface, and you have a color notebook with a future.

We also give an honorable mention to the ThinkPad 700 notebook family by IBM. The company clearly has stuck with what works—its talented crew of designers and engineers—and dropped what didn't work—its obsolete, klunky portables that were the butt of industry jokes. The monochrome unit excelled in battery life, and its color cousin has the brightest, richest color screen this side of a luggable computer. Both are full of leading-edge technology implemented to make life on the road easier.

trackball or IBM's TrackPoint II), clip-on (such as Microsoft BallPoint, meaning the unit has a cord and hangs on the side of your system), snap-on (a cordless connection device), or free-standing (such as an external mouse). A few units have a software mouse, meaning you press an activation key and then (typically) a cursor key; it's better than nothing.

The biggest innovation in this area is still to come. Microsoft's QuickPort cordless snap-on system that includes all electrical and physical connections goes a long way toward making the use of a mouse on the road easy, but it doesn't go far enough. The QuickPort trackball is still bulky, gets in the way, and will likely have to be removed for storage, but at least you don't have to connect a signal cable. Only one system in this review, the TI TravelMate 4000 WinDX2/50, uses QuickPort, and other notebooks such as Toshiba's T4500C, which should be shipping by the time you read this, will as well.

We expect that by year's end, a built-in pointing device will be a checklist item for business users. Free-standing mice won't cut it, and even the clip-on, hang-on, or screw-in devices with clunky cables will be in disfavor. Other features we saw and liked included:

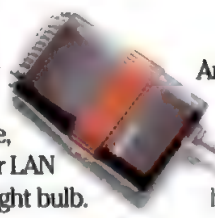
- Removable hard disks that make it easy to share data. In this review, AST, Compaq, IBM, and Swan Technologies had units with removable hard disks.
- Port replicators. For $100-$150, you get the ability to make the quick connections you'd get on a $500-$1,000 docking station. For many users, especially if you're attached to a network and can store and back up files there, a port replicator is all you need. Three vendors include this feature: AST, Compaq, and IBM.
- Built-in networking. A handful of systems either have a network attachment built-in (you may have to add an adapter cable) or available as a clip-on module.
- Super VGA or extended VGA resolution on external monitors when operating from an office or home, and dual-display capability (at VGA resolution) when doing presentations with an overhead LCD panel or large-screen monitor. Note that while video speed continues to improve, it could be better and is still dwarfed by desktop video systems.

We also saw some features that we

©1992 Xircom, Inc. Pocket LAN Adapter is a trademark of Xircom, Inc

Just how big a deal do you think it is to connect your notebook to a network?

No, you don't need a master's from MIT. Or a PhD in shop. All it takes is one free hand and a Xircom Pocket LAN Adapter.™ After a one-time, no-brainer software installation, connecting our LAN adapter is about as technical as screwing in a light bulb.



And it works with virtually any notebook and network combination. You see, we make pocket adapters for people who don't wear pocket protectors. Call 1-800-874-7875 ext.17C for more info. Better yet, have your dealer hook you up with one today.

Xircom

CIRCLE 211 ON READER SERVICE CARD

found intriguing, but that we're not going to rush out and embrace—yet:

CPU upgradability, claimed particularly for some 486 systems, could extend the life of your notebook a year or two down the road. But we're concerned about heat dissipation when you install a DX2/50 or faster processor. Maybe it will work, but we'd like to see it done in somebody else's laptop first. That goes especially for upgrades that are supposed to be compatible with Intel's version of the 586 chip, the Pentium, which is rated at 18 watts.

Three machines include the credit card–size PCMCIA expansion slots: the AST PowerExec 3/25SL, the Compaq LTE Lite 4/25C, and the Sharp PC-6881. If you've been reading *PC Magazine* for the past year, you know we've been a relatively lonely voice within the industry saying, "Great piece of technology. Now let's *a)* see something useful you can stick in it other than a 2,400-bps modem and *b)* integrate the stupid modem dongle into the machine." We're finally seeing a trickle of product announcements and a few shipments from AT&T Paradyne (14,400/9,600-bps data/fax modem), Intel (2,400-bps data modem), and Megahertz Corp. (14,400-bps fax modem), among others. Our advice: If you need a high-speed modem or a built-in network connection, PCMCIA will be great by year's end. Between now and then, your options will be a bit limited.

INTEL CHALLENGED ON CPUs

While Intel still has the lion's share of the portable CPU market, it's far from a lock. In this review, there are more systems based on the Cyrix Cx486SLC/25 CPU (nine) than anything else. Intel's most prevalent CPU was the 386SL/25 (used in six systems) and overall it had CPUs in 52 percent of the systems tested. There were also chips from IBM (the 486SLC/25) and several AMD 386 variants.

In comparing the performance levels of the CPUs in our benchmarks, note that there are 486 CPUs and then *there are 486 CPUs.* Specifically, the Cyrix and IBM 486-named CPUs have many of the attributes of Intel 486 CPUs, but they also have 16-bit data paths rather than the 32-bit data paths of Intel 486 CPUs.

Intel's portable PC plans are emerging at this point. The low-voltage 486SL line, which can operate at 3.3 volts, is just starting to appear, and is present in the Compaq LTE Lite 4/25C we tested. This chip integrates twice the raw processing power of the 386SL CPU, but requires 60 percent less motherboard space and cuts processing-power consumption in half. Currently, Intel only has a 25-MHz shipping in quantity, plus a 20-MHz unit made for NEC Technologies and a few others vendors.

Our first look at this intriguing technology was overwhelmingly positive. The Compaq LTE Lite 4/25C did well in terms of overall performance and battery life, particularly in light of the fact that the system's active-matrix color screen uses about twice as much power as a passive color display. The standard of comparison for active-matrix notebooks, Toshiba's T4400C, bested the Compaq 4/25C by a matter of minutes on our Battery Rundown test, primarily due to its heavier, more powerful battery pack.

The next step for this technology is Intel's release of a 33-MHz SL variant due out in the first quarter of 1993, with notebook systems available during the second quarter. After that, the scenario becomes hazy. Intel says it can take the SL technology to higher megahertz levels and adapt it to clock-doubling technologies (for instance, 50MHz or 66MHz inside the CPU, 25MHz or 33 MHz outside). At the same time, Intel has plans to integrate power conservation features in its DX and SX line of 486 CPUs so that desktops can take advantage of this potential power savings.

Recent press reports of the demise of the SL line appear to have been premature and greatly exaggerated. Intel says that regardless of the chips' names, the company will continue to offer processors specifically designed for portability.

REVIEW CRITERIA

We sought PC-compatible battery-powered notebook systems shipped since our previous review of 67 systems at the end of 1992 ("Portable Computers: On the

Suitability to Task: Portable PCs

The TI TravelMate 4000 WinDX2/50 was the most versatile unit reviewed. It's a quality desktop replacement and offers top-notch performance.

Road warrior/communications rates how complete a traveling companion a portable is. *Excellent* units combine small size, light travel weight, long battery life, good hard disk capacity, and good communications options.

DOS applications measures a system's ability to run DOS software quickly. *Excellent* systems have at least a 25-MHz 386 CPU, an 80MB hard disk, a 9-inch-diagonal display, and a DOSmark score in the top 25 percent.

Windows applications demand CPU speed and high-volume data storage. Top units have system RAM expandable to at least 8MB, a 120MB hard disk available, Graphics Winmark and Disk Winmark scores in the top 25 percent, a built-in pointing device, Windows-compatible power management, and good video.

A good **desktop replacement** system offers internal expansion or a docking station, has at least 120MB of hard disk space, supports Super VGA graphics on an external monitor, and has good keyboard options.

SERVICE AND RELIABILITY

In our 1992 Service and Reliability Survey, we sent questionnaires to 17,000 random *PC Magazine* subscribers; about half responded. Results are given for vendors for which we received an adequate number of responses. For more information, see our February 9, 1992, issue. Vendors are rated *above average, average,* or *below average* in satisfying computer owners' needs:

Reliability indicates whether PC owners felt their systems met their operational expectations.

Repair service results were culled from those who contacted the manufacturers to have PCs repaired.

Technical support scores indicate if technical support services met respondents' expectations.

▶ Machine Name	
SUITABILITY TO TASK	
Road warrior comm.	POOR
DOS applications	FAIR
Windows applications	GOOD
Desktop replacement	EXCELLENT
VENDOR SERVICE & RELIABILITY	
Overall Reliability	BELOW AVERAGE
Repair Satisfaction	AVERAGE
Tech Support satisfaction	ABOVE AVERAGE

Windows at your fingertips.

WinBook, the first notebook computer designed specifically for Windows.

The new WinBook™ gives you all the power to run Windows, and the unique design to make it easier to use.

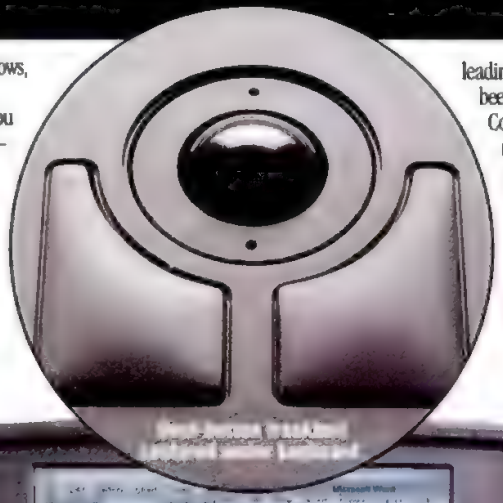
It features a built-in, centered trackball, which allows you to control cursor movements effortlessly with either thumb—without having to lift a single finger off the keyboard.

And the WinBook comes with the power and speed needed to run Windows effectively. You get 4MB of memory, the new ultrafast 486 SLC/E 25-MHz processor and the Motorola chipset which provides eight power-saving features, even while running Windows.

The WinBook was engineered for Micro Electronics, a division of MEI/Micro Center, Inc. MEI is America's leading direct source for computer accessories. Micro Center has been selling PCs for more than 14 years—longer than IBM or Compaq—with over 736,000 units sold. And with over 2.2 million satisfied customers nationwide, they have developed a superior support staff, including top engineers and technical specialists. So you always get the highest quality product at the lowest possible price.

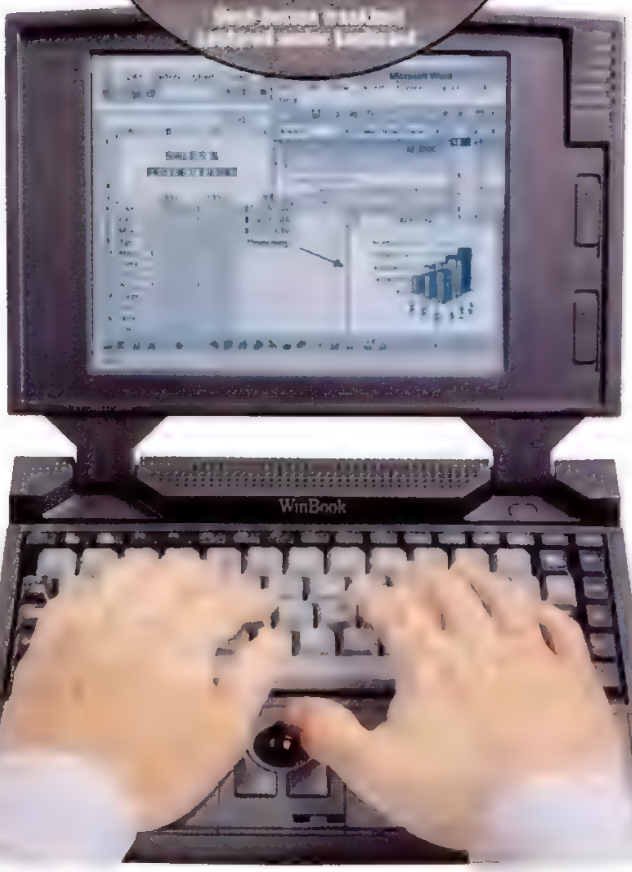
Before you choose a notebook computer, look at the only one designed for Windows.

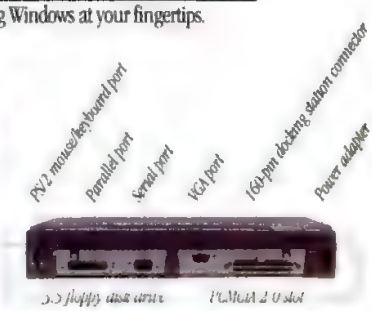
The WinBook from Micro Electronics
—putting Windows at your fingertips.



The 5.4 lb. WinBook was designed by award-winning Palo Alto Design.

- *Fast-acting Hitachi LCD screen for no cursor loss*
- *512k video RAM for simultaneous display.*
- *Includes a 9600 baud send/4800 baud receive fax/2400 baud modem*
- *Industry standard PCMCIA 2.0 slot for future expandability.*





Eight Power-Saving Features

Including sleep mode for all I/O ports, HDD, and FDD to increase battery life

Docking Station

With the available docking station, your WinBook instantly becomes a full-function desktop computer. Its two expansion slots allow you to add peripherals such as monitors, hard drives, CD ROMs or an extended keyboard. **And it's just $399!**

Longer Battery Life

The WinBook features NiMH 2300 MA batteries with gold plated contacts. This allows it to run much longer than units with traditional NiCAD batteries—and there's no memory effect.

Warranty

- *45-day unconditional money-back warranty*
- *24 hour burn-in protection*
- *One year on parts and labor*

Service

- *72-hour service turnaround guarantee*

Support

- *Toll free technical support for the life of the computer.*

Payment Options

Visa, MasterCard, Discover, personal checks, COD's with cashiers check and Purchase Orders with approval

Prices do not include applicable taxes, handling or shipping charges. Prices and specifications subject to change without notice.

©1993 MEI/Micro Center, Inc. All rights reserved. Micro Center is a registered trademark of Micro Electronics, Inc. MEI is a registered trademark and Micro Electronics and WinBook are trademarks of MEI/Micro Center, Inc. All other trademarks and registered trademarks are property of their respective corporations.

Specifications

Size/Weight
- 11" x 8 3/4" x 1 3/4"
- 5.4 lbs with battery

Pointing Device
- 16mm Alps dual-action, Microsoft compatible internal trackball

Battery
- 4 hours under normal usage
- Sanyo NiMH (no memory effect) 2300 MA with gold-plated contacts
- Worldwide auto-sensing AC adapter
- Quick 2-hour recharge

Power Management
- 8 power-saving features

Processor & Memory
- 486 SLC/E-25 CPU
- 4 MB RAM
- 1 MB ROM for Ami BIOS
- Motorola chipset & Cirrus VGA 6420
- 1k Internal Cache

Drives
- One built-in 1.44 MB 3.5" floppy drive
- Internal 120 MB (15ms) hard drive
- 180 MB (15ms) hard drive optional

Software
- Comes loaded with MS-DOS 5.0 and Microsoft Windows 3.1

Display
- Super-twisted transflective 64 gray scale, 10" LCD with CCFT-backlit
- 640x480 VGA resolution for LCD and 1024x768 for external monitor with 512k simultaneous display
- Adjustable contrast and brightness
- Visible LED indicator on cover-down

Keyboard
- Full-function keyboard with 85 keys and 4 inverted-T cursor control keys, 3.0 mm keyboard spacing

Modem
- Fax-9600 baud send/4800 baud receive/2400 baud modem

I/O Ports
- PCMCIA 2.0 slot
- Serial 9-pin connector
- Parallel port
- Video 15-pin connector for CRT
- 160-pin docking station
- PS/2 mouse interface/keyboard interface

Options
- 180 MB (15ms) hard drive
- 8 MB RAM
- Coprocessor
- Docking station

CIRCLE 085 ON READER SERVICE CARD

No-risk, 45-day unconditional money-back guarantee.

The WinBook for only

$1699

- 486 SLC/E 25 MHz
- 120 MB (15ms) HDD
- 4 MB RAM
- Fax Modem

$1499
- 80 MB (15ms) HDD
- 2 MB RAM
- Fax modem, Windows optional

Order the WinBook today. Call 1-800-448-0878

Micro Electronics, a division of MEI/Micro Center, Inc. • 1100 Steelwood Rd • Columbus, OH 43212 • Fax: 1-800-448-8308 • 8am–9pm EST, Monday through Friday • 8am–4pm EST Saturday

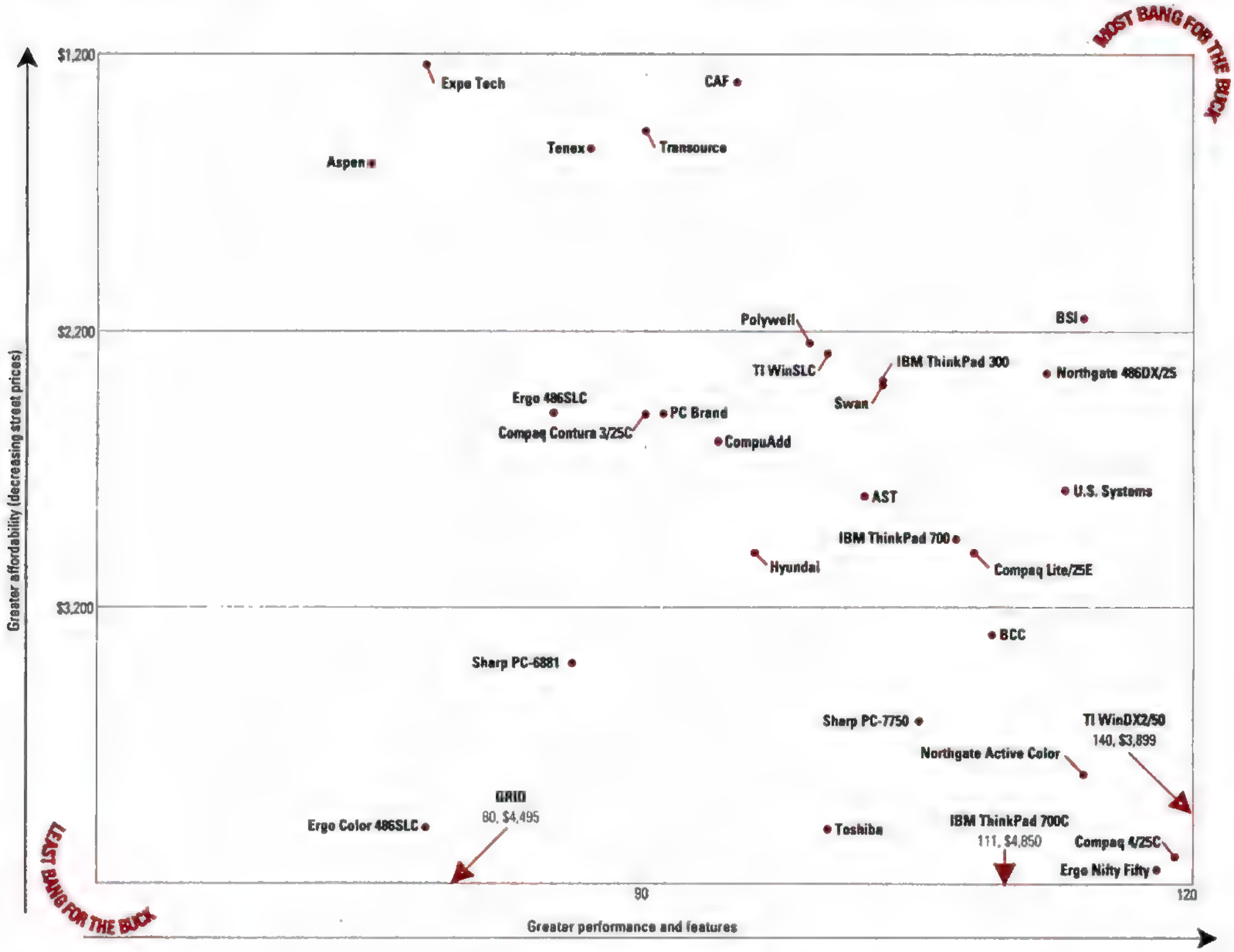
Price/Performance Index: *Portable PCs*

For performance and features, the portables in first and second place were the TI TravelMate 4000 WinDX2/50, which led the group, and the Compaq LTE Lite 4/25C, which combined 25-MHz 486 processing power with built-in power conservation. Because of their outstanding video and Graphics Winmark scores, compactness, light weight, and reasonable battery lives, these two portables are top achievers, worth their approximately $4,000 prices.

At the other extreme, five portables that cost less than $1,600 each are the value choices, if a 386 processor is all you need for computing while you're on the road. Of the five, the CAF AquaLITE-II and the Transource Verxion NB8004, each of which uses an AMD Am386SXL/25 processor, had the best combinations of performance and features.

Broadax Systems' BSI NB486DX2-50 and the Northgate ZXPortable 486DX/25 offered the best bang for the buck, but because the BSI is heavy and its battery life was unexceptional during our testing, the value edge goes to the Northgate 486DX/25.

The color units with the best compromise between price and performance/features were the passive-matrix CompuAdd 425C and PC Brand 486/SLC Color LeaderBook. Among the color choices with better performance/features scores were the Ergo Nifty Fifty 486/50 Color NoteBrick and the Northgate ZXPortable Active Color, but each of these portables also has a heavier-than-average travel weight. The Compaq LTE Lite 4/25C provided exceptional performance and features and a bright rich color screen in a 7.8-pound package—at $4,099.



THE DATA POINTS

The Bang for the Buck performance index reflects each machine's benchmark test scores, hard disk capacity, installed RAM, video RAM, processor socket, flash BIOS, and expansion features such as available drive bays and expansion slots. The index also reflects important extras such as a local bus, 16550 Universal Asynchronous Receiver/Transmitter (UART) support, an extended warranty, on-site service, and bundled software. Benchmark test scores are weighted to account for half of the performance index; capacity and expansion features account for 45 percent, and the extras account for the remaining 5 percent. You can find more data in PC MagNet's Software Library Editorial Forum as 06BANG.WK1.

Prices are based on our tested configurations (as listed in each product's fact file).

Road," *PC Magazine*, December 22, 1992). In addition, we invited back previous Editors' Choices: the Compaq LTE Lite/25E and Toshiba's T4400C, which replaced the T4400SXC. We tested machines in December, and prices are current as of early January.

We believe that the 386SX/20 or 386SL/20 CPUs and below represent the lagging edge of portable computer technology. For this review we looked only for notebooks that have at least a 25-MHz 386SX or SL Intel processor, or the AMD and Cyrix equivalents. All units had to be battery-powered and weigh less than 9 pounds. That's the upper limit of our definition of a notebook computer, and the industry seems to agree, since virtually no one is introducing portable systems that weigh more.

That filter netted us 31 systems: 19 monochrome systems, 12 color systems. All the systems we reviewed fit into the realm of notebook rather than subnotebook (sub-4-pound weight) computers, although the TI TravelMates at 4.4 pounds test the usefulness of that definition. ZDS's intriguing 3.9-pound Z-Lite 320L, with an external floppy disk drive and snap-on front-mounted trackball, shipped too late for inclusion.

WHAT WASN'T REVIEWED

As expected, what we didn't receive was at least as interesting as what we did get. In alphabetical order, those that shipped too late to be included here are: the ALR Ranger MCT 4/25s and MCT 4/25 486SX and DX variants with active color screens; the Altima SLC 33 that uses the Cyrix Cx486SLC/33 CPU; the Austin 386/SL-25 subnotebook and the 486/SX-25 Color Notebook; the Dauphin 550, powered by a Cyrix Cx486SLC/25 CPU; the Toshiba large-screen active-matrix color T4500C and passive color Satellite T1850C; and ZDS's Z-Lite 320L.

We were able to get an advanced look at a few systems that will be available in the coming months. Notable was the Toshiba T4500C, which adds to the company's legendary keyboard a sharp and bright color display from DTI, and an estimated battery life of three hours.

Another soon-to-be-released active-matrix color SL machine that we were able to try out comes from AST. Called the PowerExec 4/25SL ColorPlus, this notebook extends the present line by combining a sharp, bright color screen with power processing, about two hours of battery life and two Type II PCMCIA slots.

RECENT REVIEWS:

Low-Cost, High-Feature PCs
February 23, 1993, Page 110

DX2/66: The New Speed Limit
January 26, 1993, Page 110

Portable Computers: On the Road
December 22, 1992, Page 153

From American Mitac, a newcomer to the portable arena, comes the monochrome 4028G Notebook based on the Cyrix Cx486SLC/33 CPU that will soon be available in a color version.

But most intriguing are a unit from Orchid Technology, the video board maker, and one from Micro Center, the Columbus, Ohio–based computer store. Each company has teamed up with an American design firm and an Asian manufacturer to produce eerily similar PowerBook PC clones. Orchid's Gulliver and Micro Center's WinBook have large front-mounted trackballs and will soon be available (for more information, see the sidebar "Gulliver Travels").

Also, some have disappeared, such as Dataworld, which garnered a considerable following for its affordable lunch box systems in the late 1980s. Additionally, Librex Computer Systems, the well-financed U.S. portable PC arm of Japan's giant Nippon Steel, ceased operations on New Year's Day.

Our testing methodology, benchmark tests, and reporting of results remain virtually unchanged since our portables review of December 22, 1992. As before, we present *PC Magazine*'s benchmark tests measuring performance under DOS and Windows, battery longevity tests with power conservation disabled (the Battery Rundown test) and enabled (the ZDigit Rundown test), and a charted comparison of price versus performance (Bang for the Buck).

The one change we have made: Prices listed on our price-performance chart are once again list. Previously, we allowed a 15 percent discount for systems sold through dealers. We recently surveyed 12 of the most popular notebooks and found the discount to range between 5 and 36 percent, but overall a buyer can expect to pay close to list price. We report only the suggested list price for the system we received throughout our reviews, fact files, and features table.

IN THIS REVIEW

The 31 notebooks that met our filter are included in 25 reviews, which are arranged in alphabetical order by company name. We have reviewed essentially similar systems together: the CompuAdd 425C and PC Brand 486/SLC Color LeaderBook (reviewed under the CompuAdd heading), the Ergo Modular Color 486SLC NoteBrick and Ergo Modular 486SLC NoteBrick, the IBM ThinkPad 700 and ThinkPad 700C, the Northgate ZXPortable Active Color and ZXPortable 486DX/25, the Sharp PC-6881 and PC-7750, and the TI TravelMate 4000 WinDX2/50 and TI TravelMate WinSLC.

Aspen Computer Inc.

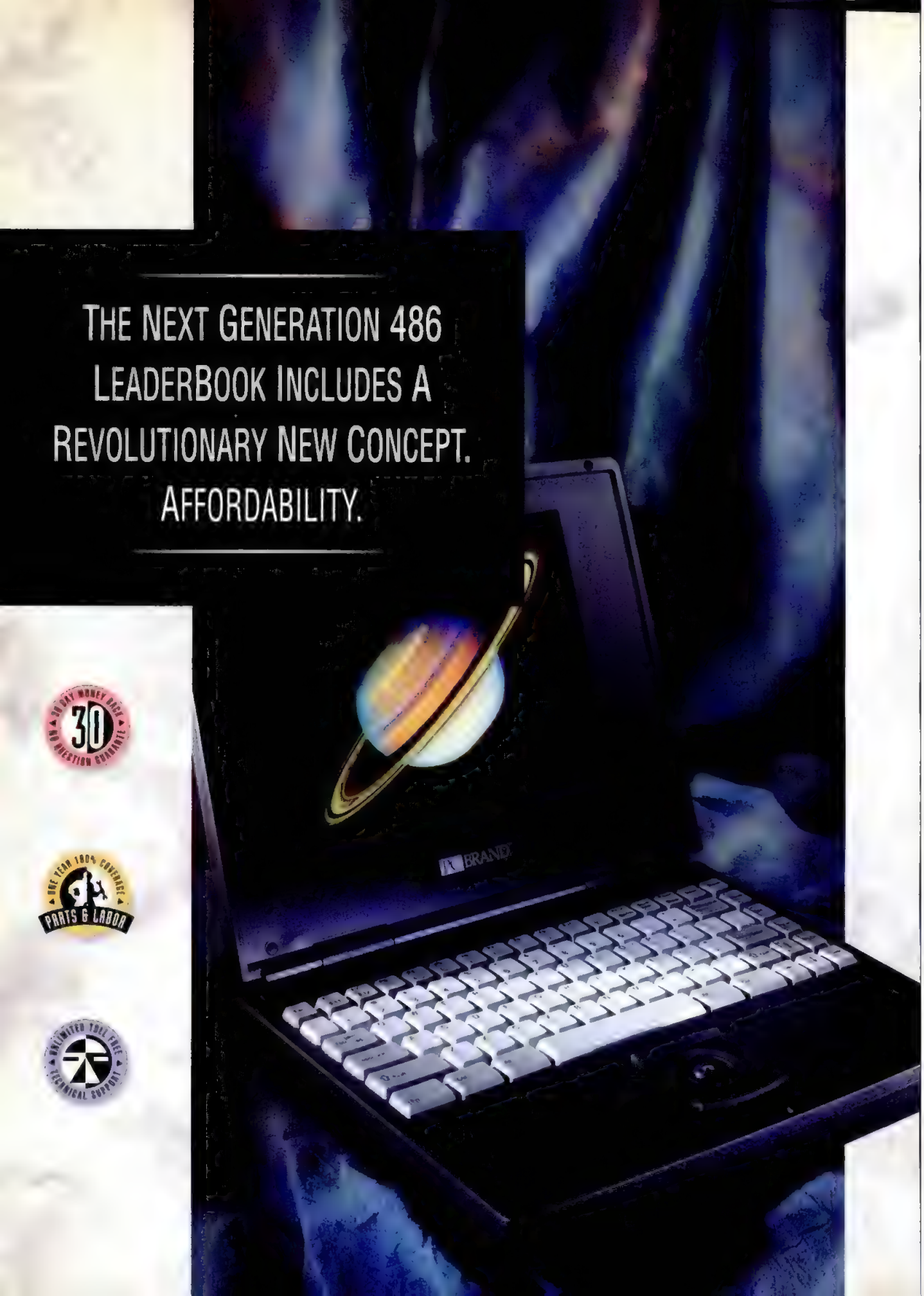
Aspen Personal 486

The $1,595 Aspen Personal 486 arrived with one of the smallest hard disks (65MB) in our review group. And with an 8.82-pound travel weight, it was among the heaviest units we saw. Neither its test results nor its features set did much to further distinguish this machine.

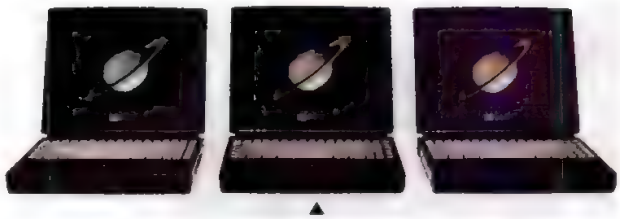
There is one advantage to the heavy case: It feels solid. Also, the keyboard has a nice, long travel, and the keys are about as large as you can expect from a notebook. The Sharp screen is crisp with very little bleeding, but the contrast isn't as sharp as in

▶ **Aspen Personal 486**

SUITABILITY TO TASK	
Road warrior comm.	FAIR
DOS applications	FAIR
Windows applications	POOR
Desktop replacement	FAIR


THE NEXT GENERATION 486
LEADERBOOK INCLUDES A
REVOLUTIONARY NEW CONCEPT.
AFFORDABILITY.
30
30 DAY MONEY BACK
NO QUESTION GUARANTEE
ONE YEAR 100% COVERAGE
PARTS & LABOR
UNLIMITED TOLL FREE
TECHNICAL SUPPORT
BRAND

Introducing an exceptional value. The new 486 LeaderBook Pro. Intelligently designed and aggressively priced because even the best technology is useless if you can't afford it. The completely new ergonomic design features a trackball centered below the keyboard allowing right or left handers equal ease of use. You'll have total control of the cursor without taking your hands off the keyboard, making this the perfect Windows™ machine. And with the support of convenient "palm rests" on either side you can work anywhere without fatigue. Choose between our paper white, high contrast Monochrome, the new super crisp *Dual Scan Color* or the radiant Active Matrix Color display. Each type provides the best display quality in its category with sharp, clear visuals. Run with either Intel's 486SX or 486DX and know you're getting one of the fastest processors in the industry, leaving the 386-based competition in the dust. All 486 LeaderBook Pros come with MS-DOS® and Windows™ 3.1 installed, plus our 30-day money-back guarantee, one year 100% parts and labor coverage and unlimited, FAX and phone toll-free technical support.



*The new **DUAL SCAN COLOR** screen gives near Active color at Passive price. A PC Brand first!*

Specifications

486SX/25 or 486DX/33 processors • 4 MB RAM • 80 or 120 MB HDD • 1.44MB, 3.5" floppy • Choice of Monochrome (13:1 contrast ratio, 10" screen), Dual Scan Color (10" screen), or the Active Color (8.5" screen) • All models support external monitor resolutions up to 1024 x 768 x 16, 800 x 600 x 256 • 1 parallel port & 1 serial port • Locking dual Ni-Cad batteries and power adapter • Full size keyboard with separate "PgUp" and "PgDn" keys, a total of 84 keys • Ergonomic palm-rest and trackball, keyboard tilt feature • 12 function keys • External keyboard port • DOS & Windows 3.1 pre-loaded • 9.2" x 11.3" x 1.9", only 6.6 pounds • carrying case

ADDITIONAL OPTIONS

FAX/MODEM • Auto adapter • Spare Ni-Cad batteries • Memory expansion cards

CONFIGURATION	MONOCHROME	DUAL SCAN COLOR	ACTIVE COLOR
486/SX-25 4 MB RAM 80 MB HDD	$1795	$2395	$3495
486/DX-33 4 MB RAM 80MB HDD	$1995	$2695	$3795
SPECIAL ! 8MB RAM 120MB HDD FAX/MODEM	ADD ONLY $499 FOR THE POWER BUNDLE!		

Call now and order direct from PC Brand.

PC BRAND™

The People's Choice.

1-800-PC BRAND

To Expedite Your Call, Please Reference Ad Code #126S

Or 1-800-722-7263 FAX 1-805-378-7801 OUTSIDE US 805-378-7848 IN MEXICO 207-9847

Sales Hours M-F 7am-9pm Sat 9am-5pm Central Time

Or FAX us anytime at the number listed for our latest quotes

TO CREATE THE PERFECT BALANCE BETWEEN PRICE AND PERFORMANCE WE RESORTED TO SOME OLD TECHNOLOGY. COMMON SENSE.

30 DAY MONEY BACK NO QUESTION GUARANTEE

ONE YEAR 100% COVERAGE PARTS & LABOR

UNLIMITED TOLL FREE TECHNICAL SUPPORT

Because no two people have exactly the same needs, each Leader Series desktop computer is designed to deliver the best performance in its class. So whatever your use, it will meet and exceed your standards. We think of it as intelligent

Specifications

	386/SX-33	486/SLC-33	486/SX-25	486/DLC-40	486/DX-33	486/DX2-50	486/DX2-66
Processor	386/SX-33	486/SLC-33	486/SX-25	486/DLC-40	486/DX-33	486/DX2-50	486/DX2-66
Memory	2MB	4MB	4MB	4MB	4MB	4MB	4MB
Hard Drive	105MB	105MB	105MB	170MB	170MB	170MB	170MB
1.44MB FDD	●	●	●	●	●	●	●
1.2MB FDD		●	●	●	●	●	●
16-bit SVGA	512KB	512KB	1MB	1MB	1MB	1MB	1MB
Color SVGA Monitor (1024 x 768)	.39 dot pitch	.28 dot pitch	.28 dot pitch	.28 dot pitch	.28 dot pitch	.28 dot pitch	.28 dot pitch
2 Serial / 1 Parallel Ports	●	●	●	●	●	●	●
Upgradable Processor			●	●	●	●	●
200W Power Supply	●	●	●	●	●	●	●
101-Key Keyboard	●	●	●	●	●	●	●
Serial Mouse	●	●	●	●	●	●	●
MS-DOS & Windows	●	●	●	●	●	●	●
CompuServe	●	●	●	●	●	●	●
Toll-Free Technical Support	●	●	●	●	●	●	●
One Year Limited Warranty	●	●	●	●	●	●	●
30-Day Money Back Guarantee	●	●	●	●	●	●	●
PRICE	$999	$1295	$1495	$1595	$1695	$1895	$2095
SPECIAL! 8MB RAM / 200MB Hard Drive/ 15"MAG Monitor & FAX/Modem				ADD ONLY $499	ADD ONLY $499	ADD ONLY $499	ADD ONLY $499

engineering, or as reviewed in *Computer Buyers Guide*, "thoughtful and innovative design." High quality components with the 200 right features at the right price. Like a slimline case that still allows for 5 expansion slots in most models and a complete line of processors that range from fast to lightening fast. A 105 or 170MB hard drive and 4 solidly built drive bays, (two 5.25" and two 3.5"). Or our high quality Super VGA color monitors that display crisp type and vivid color graphics. Backed by our 30-day money-back guarantee, 1-year 100% parts and labor coverage and toll-free tech support. Call to order and we'll prove that PC Brand is the difference between good value and great value.

"If rock bottom prices for high performance PCs keep catching your eye ...then take a look at PC Brand. They give you everything you want including low price."

PC WORLD

PC BRAND™

The People's Choice.

1-800-PC BRAND

Call for our latest special buys on top name peripherals!

To ExpediteYour Call, Please Reference Ad Code #126B

Or 1-800-722-7263 FAX 1-805-378-7801 OUTSIDE US 805-378-7848 IN MEXICO 207-9847

Sales Hours M-F 7am-9pm Sat 9am-5pm Central Time

Or FAX us anytime at the number listed for our latest quotes

• Major credit cards, checks, money orders, direct wire and approved purchase orders accepted • Free one-year on-site service on desktop systems is available to most locations in the U.S. • PC Brand reserves the right to amend specifications & prices without notifications • All non-PC Brand products and services are identified by trademarks or other service marks of their respective companies • Computer screens simulated • © PC Brand 1993

CIRCLE 029 ON READER SERVICE CARD

FACT FILE

Aspen Personal 486

Aspen Computer Inc., 5813 Main St., #10, Buffalo, NY 14221; 800-472-3273, 716-626-0315; fax, 716-626-1541

List price: $1,595.

Tested configuration: 5MB 80-ns RAM, 65MB Conner CP 2064 IDE hard disk with 32K buffer, 1.44MB floppy disk drive, 9,600-/2,400-bps data/fax modem, DOS 5.0, Microsoft Windows 3.1, and nylon carrying case.

Options: 4MB RAM upgrade, $190; docking station, $595; Ethernet adapter, $245; extra battery, $65; 12-volt battery adapter, $95.

In short: The Aspen Portable 486 is a heavy machine with a small hard disk, and most of its other components didn't outshine those of its competitors. The unit's relatively light battery also logged one of the shortest battery-rundown times in this review. You may find the Aspen's solid case and adequate screen acceptable, though.

492 ON READER SERVICE CARD

some other machines. The screen, Cirrus Logic video card, and processor combination was slow when generating a Microsoft Windows image.

There's no trackball, but since few of our technicians were very pleased with the low-drag trackballs found on many of the notebooks, you may want to purchase Thumbelina or some other clip-on device. There's room for such an addition since the floppy disk drive is on the front.

Power conservation is remarkably flexible. The screen and hard disk can be set to shut down at adjustable intervals ranging from 1 to 99 minutes. That would come in handy because at 1 hour 25 minutes, with power management disabled, its Battery Rundown test score was one of the shortest battery ratings we saw. On our ZDigit Rundown test, with power management enabled, it lasted 2 hours 34

Battery Life vs. Portability

The majority of machines we tested weighed about 8 pounds, forming a band through the center of the Battery Life vs. Portability chart.

Whether you aim to use your new portable computer on an airplane, in a classroom, or in the press box at Fenway Park, the true usefulness of a portable rests in part on how much time and distance you can comfortably put between yourself and the nearest AC power outlet.

Long battery life by itself, however, is often not enough. If your portable is heavy enough to make your arms weary or your knees ache, your personal productivity may suffer.

In this group of 31 systems, 8 units weighed in at less than 7.5 pounds. Several of the other notebooks turned out to be just 7.5 or a few ounces heavier.

The two models from Texas Instruments offer the lightest available system weight along with excellent battery life. Take your pick between the top-performing TI TravelMate 4000 WinDX2/50, which was one of the three Editors' Choices in this roundup, and the lower-priced TI TravelMate WinSLC. Both systems lasted more than 3 hours on our harsh Battery Rundown test. The WinDX2/50 achieved this longevity primarily by means of its power-management feature, which shuts down the power-hungry CPU between keystrokes. Its Cyrix-powered cousin owed its success to its CPU's inherently low power usage.

Slightly heavier but still in the 3-hour battery-life range is another one of our Editors' Choices: the Compaq LTE Lite/25E, which includes the best monochrome screen available, making it a roadworthy favorite.

The AST Power Exec 3/25SL, the IBM ThinkPad 300, and the IBM ThinkPad 700 each weigh a bit more than the Lite/25E but still less than 8 pounds; any one of these three lasted well over an hour longer than the average tested machine on a full battery charge. The IBM ThinkPad 300 has an arsenal of useful power-management features that make it the endurance leader, with a battery life of 4 hours 18 minutes.

The one remaining Editors' Choice selection, the Compaq LTE Lite 4/25C, found itself nestled with a number of lesser-performing machines in the busiest portion of our chart comparing battery life and portability—but don't let that fool you. While this machine's Battery Rundown time was a hair below the average, once we enabled its power-management features the unit's battery life (its ZDigit Rundown score) emerged among the best in the roundup.

The Lite 4/25C's battery life is even more impressive when you take its beautiful active-matrix color screen into consideration. Even most of the monochrome units with all their power conservation features couldn't keep up with the Lite 4/25C's ZDigit Rundown score.

The Sharp PC-6881 and Hyundai Courier Spectra shared the dubious honor of having meager rundown times. The Hyundai is the featherweight of this review group, and its short battery life was to be expected. It produced a more respectable ZDigit Rundown score of 2 hours 35 minutes when its power conservation features were enabled. Note, however, that the Sharp notebook can accept an extra clip-on battery, which will ensure a more acceptable battery life.

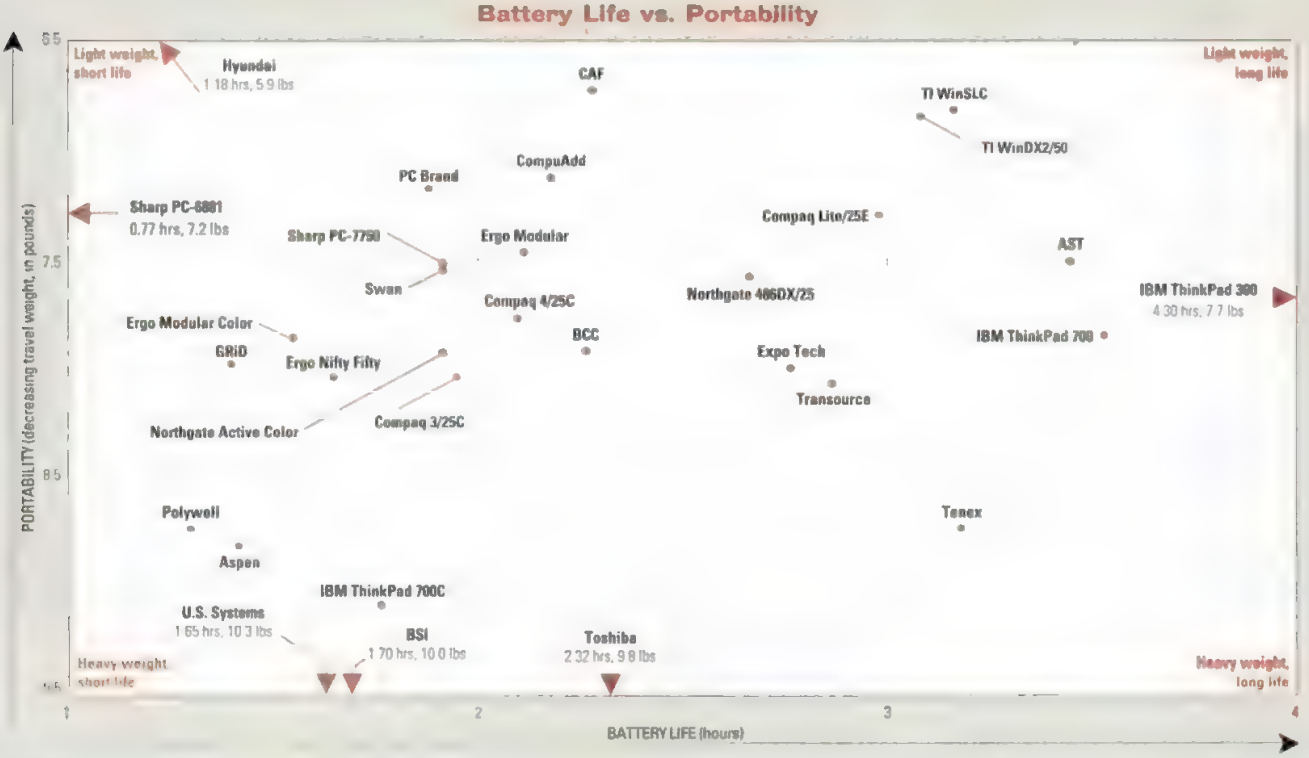
U.S. Systems and Technologies' U.S. Professional Notebook 486DX and Broadax Systems' BSI NB486DX2-50 claimed the 10-pound overweight awards, making them unacceptable for life on the road. Ironically, neither of these units came close to the average battery life for the 31 machines in this test of laptop computers (roughly 2 hours 15 minutes). The poor battery showings for these two models were even more surprising since both machines had batteries that were among the heaviest tested.

Marginally lighter was the Toshiba T4400C, long the standard by which all notebooks have been measured. Not long ago it was regarded as the leanest and meanest color portable machine in all the land. Today, however, the Toshiba appears to be overweight, though it produced a Battery Rundown time slightly better than average.

	ZDigit Rundown time (hours: minutes)	Rank	Battery Rundown time (hours: minutes)	Rank	Battery weight (pounds)	Rank	Battery life per pound (hours: minutes)	Rank	System weight (pounds)	Rank	Travel weight with adapter (pounds)	Rank
Aspen Personal 486 (Cx486SLC/25)		22			1.2	10			7.2	27	8.8	27
AST PowerExec 3/25SL (386SL/25)		9			1.5	27			6.2	12	7.5	9
BCC Avanti 486/V32 Model 200 (Cx486SLC/25)		16			1.2	10			6.6	20	7.9	16
BSI NB486DX2 50		28			2.2	29			8.5	31	10.0	30
CAF AquaLITE-II (Am386SXL/25)		10			1.1	7			5.4	3	6.7	2
Compaq Contura 3/25C (386SL/25)		10			1.3	15			7.0	25	8.0	20
Compaq LTE Lite 4/25C (486SL/25)		4			1.3	15			6.6	20		15
Compaq LTE Lite/25E (386SL/25)		4			1.3	15			6.5	16		
CompuAdd 425C (Cx486SLC/25)		26			1.3	15			5.9	6		
Ergo Modular 486SLC (Cx486SLC/25)		17			1.1	7			6.1	10		9
Ergo Modular Color 486SLC (Cx486SLC/25)		24			1.1	7	01:24	22	6.5	16	7.9	16
Ergo Nifty Fifty 486/50 Color (486DX2/50)		25			1.3	15	01:16	24	6.6	20	8.0	20
Expo Note 33 (Am386SX/SL-33)		14			1.0	3			6.5	16	8.0	20
GRiD 1660C (386SL/25)	02:48	17	01:24	28	1.0	3	01:24	22	6.8	23	8.0	20
Hyundai Courier Spectra (Cx486SLC/25)			01:	30	0.7	1			5.7	4	5.9	1
IBM ThinkPad 300 (386SL/25)	05:09	2	04:	1	1.2	10			6.0	8	7.7	14
IBM ThinkPad 700 (IBM 486SLC/25)	04:11	4	03:	2	1.4	24			6.5	16	7.9	16
IBM ThinkPad 700C (IBM 486SLC/25)	03:30	13	01:46	22	1.4	24	01:15	25	7.6	29	9.1	28
Northgate ZXPortable 486DX/25	03:15	12	02:40	10	1.0	3					7.6	12
Northgate ZXPortable Active Color (486SX/25)	02:48	17			1.0	3					7.9	16
PC Brand 486/SLC Color (Cx486SLC/25)	01:52	30			1.3	15	01:26	21	6.0	8	7.2	6
Poly NB433DX (486DX/33)	02:06	23			1.2	10	01:05	27	7.1	26	8.7	25
Sharp PC-6881 (386SL/25)	01:10	31	00:46	31	0.8	2				4	7.2	6
Sharp PC-7750 (486DX/33)	02:33	21	01:55	18	1.3	15	01:28	20	6.1	10	7.5	9
Swan 486/SLC 25 Notebook (Cx486SLC/25)	02:48	17	01:55	18	1.2	10	01:35	18	6.2	12	7.6	12
Tenex Notebook 386DXL/33 (Am386DXL/33)	04:11	4	03:11	4	1.9	28	01:40	15	7.4	28	8.7	25
TI TravelMate 4000 WinDX2/50 (486DX2/50)	05:21	1	03:05	6	1.3	15	02:22	6	4.4	2	6.9	4
TI TravelMate WinSLC (Cx486SLC/25)	05:08	3	03:10	5	1.3	15		5			6.8	3
Toshiba T4400C (486SX/25)	03:44	10		11	2.4	31		28	9	30	9.8	29
Transource Version NB8004 (Am386SXL/25)			02:52	8	1.4	24	02:02	10	6.9	24		24
U.S. Professional Notebook 433DX (486DX/33)	02:07	26	01:39	24	2.2	29	00:45	31	6.4	15		31

Rank: Number 1 represents the top ranking

Battery Life vs. Portability



minutes. Its Windows performance was near the bottom of the pack.

The Aspen's Cyrix 486SLC/25 CPU, arrayed against both lesser-ranked Intel 386s and other types of 486s, ranked about average. Its 5MB of RAM, though more than the average 4MB, yielded only an average memory score.

Aspen includes a one-year parts-and-labor warranty.—*Andrew Collier*

AST Research Inc.

AST PowerExec 3/25SL

AST Research is introducing a new look with its $2,795 AST PowerExec 3/25SL. Gone is the oversized and overweight beige case; its sleek-looking gray replacement holds a variety of hot options.

The case houses an Intel 386SL/25 processor backed by a 64K external cache. RAM goes up to a whopping 32MB, and you can change the monochrome display to a passive-matrix color version for $1,499. Active-matrix color will be available but was not priced at the time of this review. Other features include a removable hard disk and a special key-based security system. A software feature lets key combinations simulate a mouse, though you may not need it because AST now includes a snap-on, front-mounted SmartPoint cable-free trackball on all these models. A port replicator and a docking station are optional. Modem options depend entirely on the unit's two Type II PCMCIA slots.

AST PowerExec 3/25SL

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	FAIR
Windows applications	GOOD
Desktop replacement	FAIR
VENDOR SERVICE & RELIABILITY	
Overall Reliability	AVERAGE
Repair Satisfaction	AVERAGE
Tech Support satisfaction	AVERAGE

Performance was fair for a 386-based machine pitted against 486s. The video scores under both operating systems were excellent, ranking third under DOS and thirteenth under Microsoft Windows. But disk scores fell into the bottom quarter under both operating systems. Battery life for the nickel hydride battery was much brighter: 3

Benchmark Tests: Low-Cost PCs

What the Numbers Mean

The 31 notebook systems we examined represent ten different CPUs and a variety of approaches to putting lots of performance in a little space. The very best units approach the processing power of desktop systems, although portables still lag well behind desktops in terms of video performance.

PROCESSOR AND MEMORY

New processors from Advanced Micro Devices (Am386SXL/33 and Am386DXL/33), IBM (486SLC/25), and Intel (486SL/25) and the disappearance of 20-MHz chips helped this issue's laptops achieve processor and memory scores averaging 16 percent higher than those in our last laptop roundup (December 22, 1992).

The TI TravelMate 4000 WinDX2/50 was the most powerful portable we've seen, performing 12,369 processor operations per second and handling 8,476K per second in memory operations. At 4.4 pounds, the thin but sturdy WinDX2/50 was also one of the lightest units in the entire test group.

At the other end of the processor-performance spectrum were the nine systems based on Cyrix's Cx486SLC/25 CPU. In this group, the CompuAdd 425C produced the slowest processor performance, while the TI TravelMate WinSLC led in this category.

The next most popular processor was Intel's 386SL/25 chip, found in six of the machines. The SL's integrated cache helped these units achieve decent processor scores ranging from 3,221 operations per second for the IBM ThinkPad 300 down to 2,893 operations per second for the Sharp PC-6881. Expo Tech's Expo Note 33, with the Am386SX/SL-33 chip, used 70-ns interleaved RAM to maintain decent performance on our memory test suite. The CAF Aqua-LITE-II and the Transource Verxion NB8004 used comparable RAM but with weaker results.

The ThinkPad 700–series units sport IBM's new 486SLC/25 chip, a licensed offshoot of Intel's 486 family. These units and the AMD Am386DXL/33–based Tenex Notebook 386DXL/33 achieved midrange processor scores of 4,364 and 4,492 operations per second, respectively. On our memory test suite, the Tenex Notebook's paged, interleaved memory architecture helped it perform roughly on a par with the Compaq LTE Lite 4/25C, which is based on the 486SL/25 CPU, the newest member of Intel's family of processors. The Tenex's processor and memory scores were comparable with those of 25-MHz 486 units. Among the 486SX/25 units, the Toshiba T4400C stands out, with its custom support chips, its paged, interleaved memory architecture, and its fast 65-ns DRAM. It easily surpassed the 486SX/25 group's average processor and memory marks.

DOS VIDEO

Average DOS video performance improved by 25 percent since our last laptop review. Fully 28 percent faster than its nearest competitor, the top-performing ThinkPad 700C combines a proprietary IBM chip set and a peerless 10.4-inch, active-matrix color display. For the remainder, the demands of LCD screens continued to overwhelm the portables' processors and bus systems. The 486SX/25-based Toshiba T4400C (with its Western Digital WD90C30 video chip set) and the 386SL/25-based AST PowerExec 3/25SL (with the WD90C26 chip set) placed second and third, respectively.

The top seven DOS video performers all use active-matrix displays. There is a sharp drop-off in performance for the machines that do not use active-matrix technology, and the worst scores

here were only slightly better than the worst scores in our last laptop review. The Aspen Personal 486, Sharp PC-6881, BSI NB486DX2-50, U.S. Professional Notebook 486DX, Northgate ZXPortable 486DX/25, and Ergo Nifty Fifty 486/50 Color NoteBrick performed less than 1 million video operations per second in spite of their disparate processors and video chip sets.

DOS DISK

Laptop disk performance is generally slow compared with desktop systems: Notebook disk controllers contain little or no RAM cache, and few laptops support new high-speed IDE drives with a 24-megabit-per-second internal transfer rate. Average disk scores rose only 12 percent since our last laptop review.

The BSI NB486DX2-50 with its top-performing Western Digital WDAC2200 hard disk led the group, at 35.73K per second. The TI TravelMate 4000 WinDX2/50, using Seagate's 128MB ST9144A hard disk, was second, with a DOS disk score 21 percent below the BSI unit.

DOSMARK

The DOSmark results depend mainly on disk and processor performance. The top ten systems on our processor and disk test suites also had the top DOSmark scores. The TI TravelMate 4000 WinDX2/50 led with a score of 31.92, followed closely by the BSI NB486DX2-50 at 30.19. The next two, the Ergo Nifty Fifty 486/50 Color NoteBrick and the U.S. Professional Notebook 486DX, received much lower scores—26.51 and 26.16, respectively—and the scores fell off sharply after that.

GRAPHICS WINMARK

The mean Graphics Winmark score improved 22 percent since our last laptop roundup (December 22, 1992), and the top-ranked units are approaching respectable desktop performance. The TI TravelMate 4000 WinDX2/50, which was tied for first place, uses the same Cirrus Logic chip set (Model GD6420) as the TI TravelMate 4000 WinDX/25, the champ in our last laptop review. The current model's 20 percent performance improvement over the earlier TravelMate is primarily based on improved processor speed.

Nine of the top ten Graphics Winmark performers were based on Intel 486 designs. The only non-486 design in the top ten is the Tenex Notebook, based on an AMD Am386DXL/33 chip. Tenex used the same Chips & Technologies chip set (Model 82C456) that appears in our lowest-ranked system, the Sharp PC-6881, yet its Graphics Winmark score was nearly double that of the Sharp.

DISK WINMARK

We set up a 1MB SmartDrive 4.0 software cache to represent a typical Windows setup for a portable with 4MB RAM. As it turned out, the top five DOS processor performers achieved the best Disk Winmark scores. The BSI NB486DX2-50 was in a virtual tie with the TI TravelMate 4000 with Disk Winmark scores of 33.82 and 33.27 kilobytes per second, respectively.

How We Tested

In preparing this issue, we used PC Magazine Labs' Hardware Benchmark Tests, Release 7.0, to predict PC processor, memory, video subsystem, and disk performance using DOS applications. Each of the four scores we report is the weighted harmonic mean of the results from several tests, expressed in terms of throughput or operations per second. These results are summarized in a composite score called the DOSmark.

We also used the Windows Benchmark Tests (Winbench), Release 3.1, to obtain the Graphics Winmark and Disk Winmark scores, which predict the relative performance levels using popular Windows applications.

The **processor** score is a measure of the CPU's performance and its interaction with cache and main memory. It is derived from tests that use small and medium-size instruction mixes, along with either the floating-point calculation test or the coprocessor test (depending on the presence or absence of a math coprocessor). The score indicates how well a computer's CPU and cache subsystems would execute common DOS and Windows applications.

CONTINUES

Eliminate islands of automation.

Macola Accounting Software powers corporate connectivity.

Unproductive islands exist throughout your company... computerized departments that can't communicate.

Now they can. With Macola Software, you can bridge these communication gaps and seamlessly connect your PCs and your people. Imagine the benefits of linking these departments for shared operations, reporting and analysis:

Inventory	*Accounting*
Purchasing	*Manufacturing*
Shipping	*Sales/Marketing*
Maintenance	*Engineering*
Point-of-Sale	*Executive Office*
MIS/DP	*Customer Service*

Your productivity bridge.

Eliminating your islands of automation begins with Macola Accounting Software. Macola processes the information flow from all departments so you can get the right information to the right person at the right time. For all the details, call today.

1-800-468-0834

MACOLA® SOFTWARE

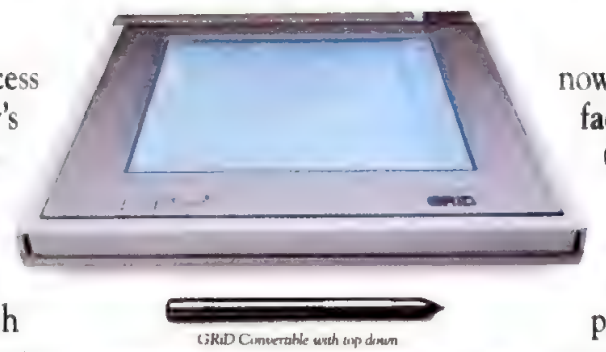
333 E. Center St. Marion, OH 43302-4148

Macola is a registered trademark of Macola, Inc. Copyright 1992.

CIRCLE 263 ON READER SERVICE CARD

WE'RE SELLING GOVERNMENT SECRETS.

Now you have access to one of our country's most valuable technological secrets – a secret that goes with NASA astronauts into space and with American troops into battle. For years, Fortune 1000 companies have taken advantage of the same secret to aid them in everything from drilling for oil to accessing competitive information. The secret? GRiD™ computers. Until now, these leading-edge machines were available only to government and corporate entities. But now you can order products **factory-direct** from GRiD On-Line Express. GRiD is a PC-industry leader and a technology innovator. We invented portable computers when we introduced the GRiD Compass™ in 1982. Since then, we have earned a reputation for producing ultra-reliable, technologically-advanced hardware and software, especially in the area of pen-based computers. Now our product line is available to you, simply by calling GRiD On-Line Express toll-free.



GRiD Convertible with top down

GRiD Convertible with top up

GRiD

All products subject to availability. Prices do not include applicable sales tax, shipping and handling. All prices and product descriptions and specifications are subject to change without notice. GRiD is not liable for damage due to omissions or typographical errors. All trademarks are the property of their respective companies.

GRiD CONVERTIBLE™

Our newest offering, this machine makes mobility your secret weapon, by giving you the best of both worlds - a pen tablet and notebook computer built into one.

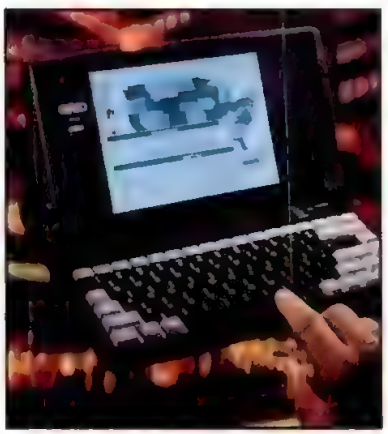
GRiD CONVERTIBLE™

• 25 MHz 386 SL • 2 MB RAM • 125 MB Hard Drive • External 3.5" 1.44 MB Floppy Drive • Match co-processor • PCMCIA 2.0 slot • Electronic pen for input, replacing the mouse • DOS 5.0 •Windows 3.1/Windows for Pen computing • Magnesium case. Order # 3-16230M

$2,999.00 Special Offer

SPECIAL OFFER!

Place an order for the 1755/486 Notebook through our GRiD On-Line Express number before March 31, 1993 and receive a free fax/modem. ($300 value)



GRiD 1755/486 NOTEBOOK

Rugged and reliable, in the tradition of all GRiD products.

• 20 MHz 486 SLC • 4 MB RAM • 80 MB Hard Drive • 3.5" 1.44 MB Floppy Drive • 8.5" Side-lit VGA LCD Screen •6.25 pounds • DOS 5.0 • Windows 3.1 • One-year carry-in warranty. Order # 3-16758M

$1,999.00 Special Offer

MFP+ SERIES

All MFPs come with these powerful features.
• 1.44 MB 3.5" Floppy Drive • 5 ISA Expansion Slots • 14" 1024x768 .28 dot pitch monitor • MS DOS 5.0 and Windows 3.1 • 101 Keyboard.

GRiD MFP/425s+ •25 MHz Intel 486SX Processor • 4 MB System Memory • 130 MB 16ms IDE Hard Drive • 512K VRAM. Order # 3-1625XM

$1,399.00 Special Offer

GRiD MFP/433s+ •33 MHz 486 SX Processor • 4 MB System Memory • 128K External Cache • 170 MB 13ms IDE Hard Drive • 1 MB VRAM. Order # 3-1633XM for 433s+

$1,699.00 Special Offer

To order the same configuration as the 433s+ with the 486DX Processor, order # 3-1633DM for the MFP/433+

$1,999.00 Special Offer

GRiD MFP/450+ •50 MHz Intel 486DX2 Processor • 4 MB System Memory • 128K External Cache • 213MB 13ms IDE Hard Drive • 1MB VRAM. Order # 3-165ODM

$2,299.00 Special Offer

GRiD MFP 466+ •66 MHz Intel 486 DX2 Processor • 8 MB System Memory • 256K External Cache • 340MB 13ms IDE Hard Drive • 1MB VRAM. Order # 3-1666DM

$2,699.00 Special Offer

TO ORDER: 1-800-934-GRiD

To Order By FAX: 817-347-7679

- Factory direct pricing • Custom-configured exactly to your needs
- 100% compatible – Guaranteed! • 30-day money back guarantee
- 1 year on-site service warranty for all desktops
- 1 year toll-free technical support

GRiD ON-LINEXPRESS

Built in the USA.

Other configurations are available – call for details. Hours of operation 8am to 6pm CST Monday - Friday. All prices shown are special offers only.

CIRCLE 014 ON READER SERVICE CARD

Benchmark Tests: Portable PCs

The **memory** score is compiled from 8-, 16-, and 32-bit extended-memory read and write tests, as well as 8- and 16-bit conventional-memory read and write tests. Taken together, these tests reflect the throughput of a computer's main memory.

The **disk** score measures throughput using standard DOS INT 21h file I/O calls. The tests measure the speed of file reading and writing, both sequentially and randomly, for a range of file sizes from 256K to 32MB. The tests are performed without software disk caches installed.

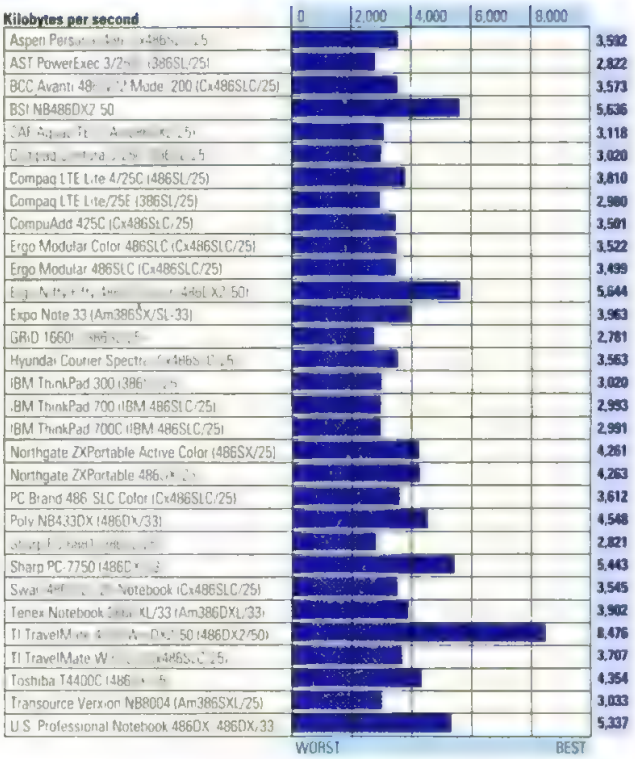
The **video** score is based on direct-to-screen text-write and graphics-write tests. Taken together, these tests reflect the video throughput for a standard EGA/VGA adapter running DOS applications.

The **DOSmark** score is a composite rating that is derived from the processor, memory, video, and disk scores. The DOSmark indicates a PC's ability to run DOS applications.

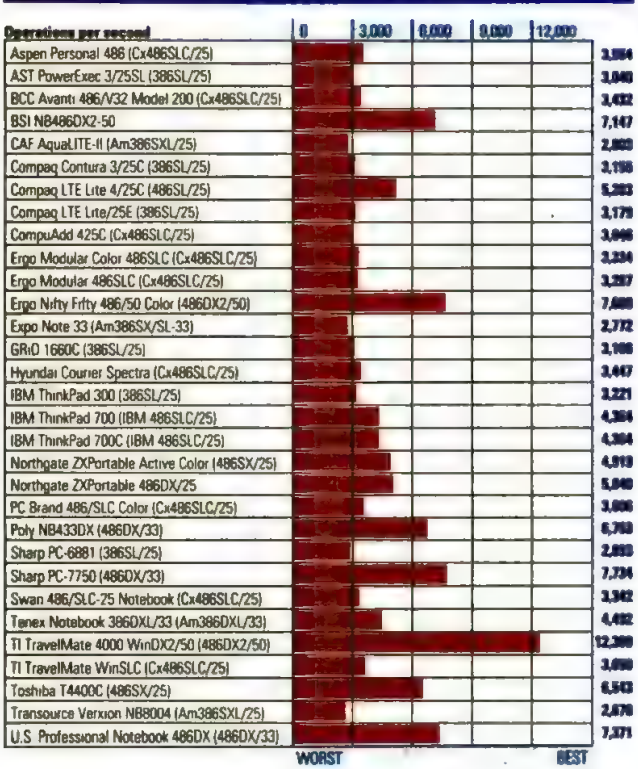
The **Graphics Winmark** score is based on 12 Windows graphics and text functions that are derived from extensive profiling of popular Windows applications. This score is measured in megapixels per second (a megapixel is 1,048,576 pixels).

The **Disk Winmark** score is based on testing techniques adapted from the DOS disk tests to reflect operations within the Windows environment. For this portion of the testing, the systems were configured with up to 2MB of SmartDrive cache.

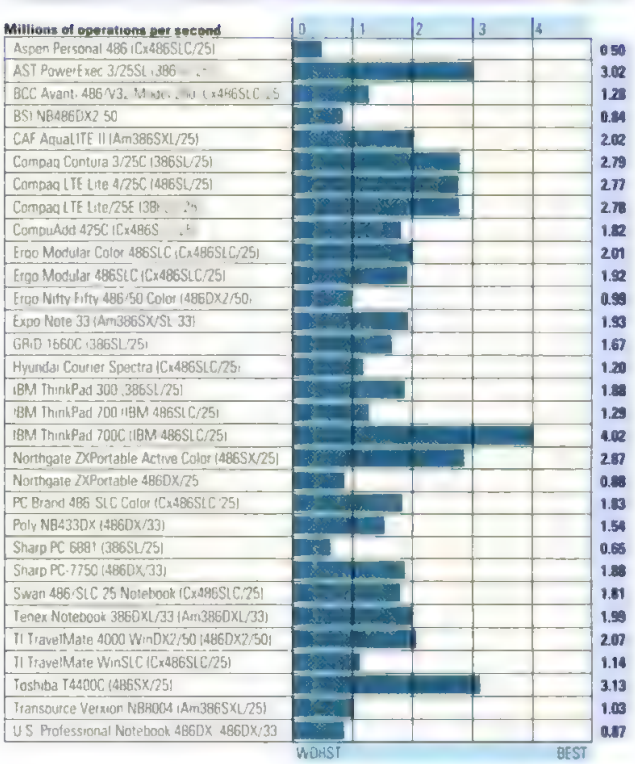
MEMORY



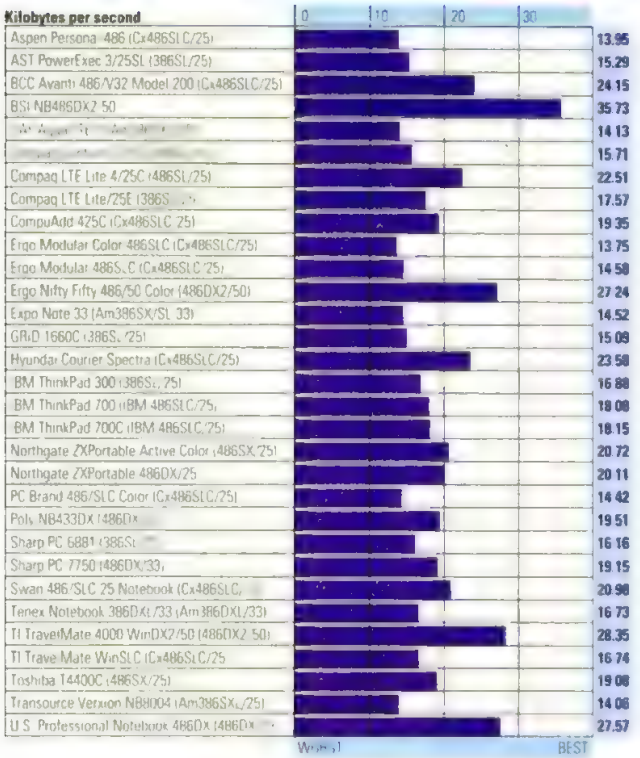
PROCESSOR



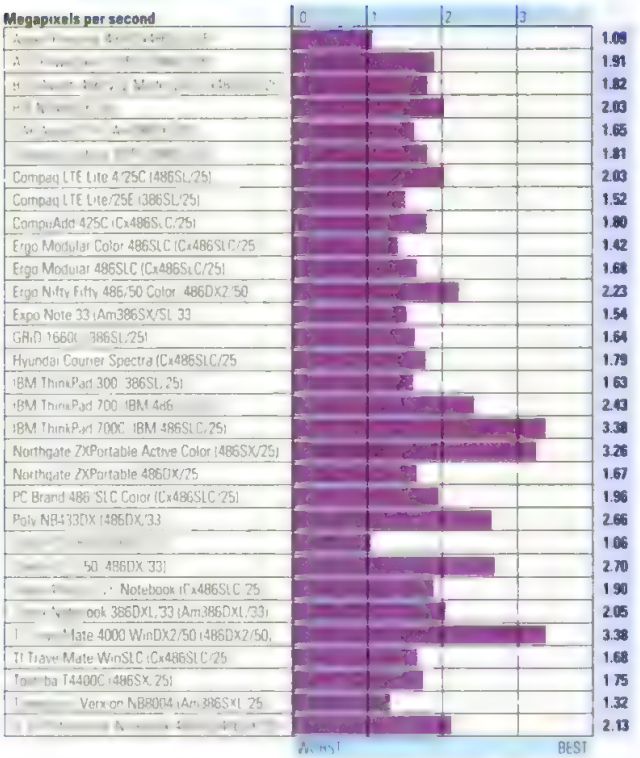
VIDEO



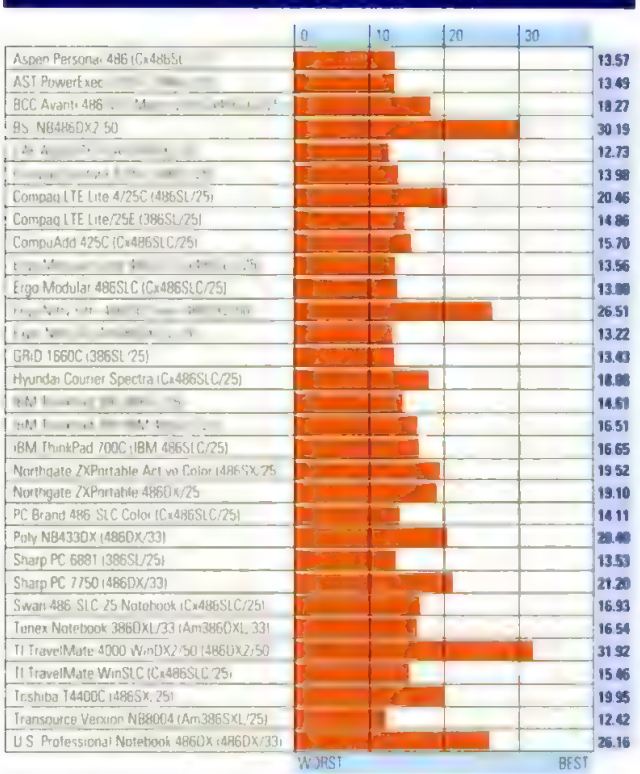
DISK



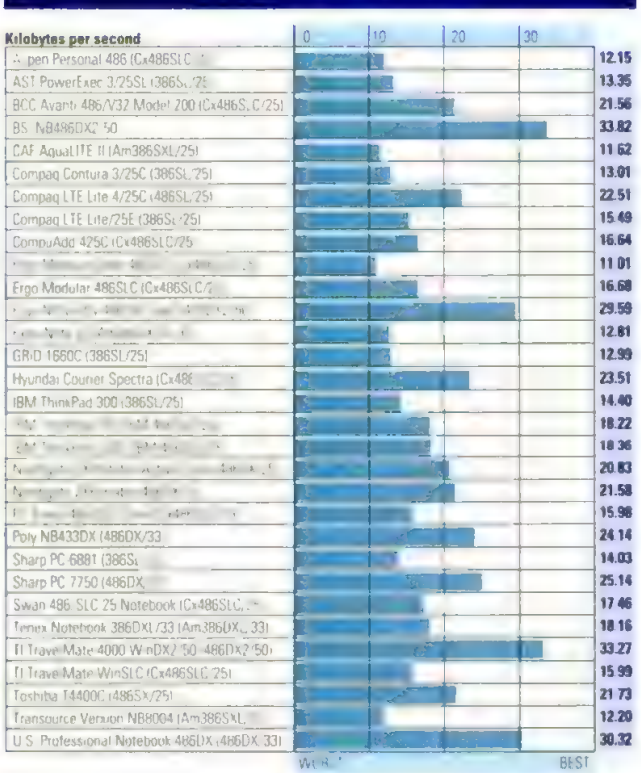
GRAPHICS WINMARK



DOSMARK



DISK WINMARK



FACT FILE

AST PowerExec 3/25SL

AST Research Inc., 16215 Alton Pkwy., Irvine, CA 92713; 800-876-4278, 714-727-4141; fax, 714-727-9355

List price (tested configuration): $2,795.

Tested configuration: 4MB 80-ns RAM with 64K external cache, 120MB Toshiba MK2124FC IDE hard disk with 32K buffer, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1.

Options: 200MB hard disk, $800; 4MB RAM upgrade, $249; 8MB RAM upgrade, $1,099; trackball, $69; docking station, $449; port replicator, $99; extra battery, $199; 2,400-bps data modem, $279; 9,600-/2,400-bps data/fax modem, $379; 14,400-/9,600-bps data/fax modem, $599; Ethernet adapter, $329; external keyboard, $79; numeric keypad, $99; battery charger, $49.

In short: AST Research's new PowerExec line sports a plethora of options and decent performance. This heavyweight contender is also backed by a trusted name.

489 ON READER SERVICE CARD

hours 27 minutes on our Battery Rundown test, with power saving disabled, and 3 hours 58 minutes on our ZDigit Rundown test, with power saving enabled.

As mentioned in the introduction, Digital Equipment Corp. is buying the AST and reselling it under its own name.

AST backs all its systems with a one-year warranty and a 48-hour repair time after it receives the unit; 24-hour turnaround is available under the extra-cost ExeCare Plus program.—*Oliver Rist*

BCC

BCC Avanti 486/V32 Model 200

Compared with other monochrome notebooks based on the Cyrix Cx486SLC/25 processor, the $3,295 BCC Avanti 486/V32 Model 200 is fairly pricey. But it offers a uniquely sleek look, a fleshed-out feature set that includes a high-speed internal modem, and competitive performance.

BCC Avanti 486/V32 Model 200

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	GOOD
Windows applications	FAIR
Desktop replacement	FAIR

The BCC's case stands out among the other notebooks, and the unit's pivoting screen is a nice touch—although it unfortunately prevents you from pushing the screen back 180 degrees so that it will fit underneath an external monitor.

The keyboard is well laid out, with properly sized keys that have only a slightly tough resistance. Instead of jumping on the Personal Computer Memory Card International Association (PCMCIA) bandwagon, however, BCC has chosen to stick with a traditional internal 9,600-bps fax modem. The only serious drawback of the case is its cover for the battery; putting back the slide-on door is extremely annoying until you get the hang of it.

Beyond this, however, BCC seems clearly in touch with its customers' needs. The Avanti boasts such features as Flash ROM BIOS and a quick-charge nickel cadmium battery. You can get a math coprocessor to help Cyrix's silicon, but an external cache is not available.

On our benchmark tests, the Avanti turned in mostly average scores. Only its Toshiba hard disk excelled, scoring in the top ten under DOS and just below the top ten under Windows. The unit's battery life was better: 2 hours 16 minutes on our Battery Rundown test and 2 hours 49 minutes on our ZDigit Rundown test. BCC offers a one-year parts-and-labor warranty, toll-free technical support, and a 24-hour bulletin board.—*OR*

FACT FILE

BCC Avanti 486/V32 Model 200

BCC, 1610 Crane Ct., San Jose, CA 95112-4201; 800-827-4222, 408-944-9000; fax, 408-944-0657

List price: $3,295.

Tested configuration: 4MB 70-ns RAM, 200MB Toshiba MK-2224FC IDE hard disk with 132K buffer, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1, 9,600-bps data/send-only fax modem, Thumbelina, Magic Cursor!, Terminal Plus, WinFAX 2.0.

Options: 4MB RAM upgrade, $200; extra battery, $100; 12-volt battery adapter, $40.

In short: The BCC Avanti 486/V32 Model 200 should satisfy everyone. BCC has attended to all the details, including such innovations as a pivoting screen that makes the unit easy to use in tight places. A sleek case encloses a sloping keyboard that makes typing easier. Though the price is a little high for a monochrome unit, this portable may well be worth it.

494 ON READER SERVICE CARD

Broadax Systems Inc.

BSI NB486DX2-50

Priced at only $2,150 and equipped with a scorchingly fast 486DX2/50, the BSI NB486DX2-50 should slice off a solid piece of the market-share pie.

Unfortunately, Broadax Systems packs all this high-tech equipment into a case that we also saw on the Aspen Computer and Ergo Computing entries during our last laptop review (December 22, 1992). The case is bulky enough by itself, and the battery screws onto the *outside*, adding further girth.

BSI NB486DX2-50

SUITABILITY TO TASK	
Road warrior comm.	FAIR
DOS applications	EXCELLENT
Windows applications	GOOD
Desktop replacement	GOOD

On the inside, this system has a large, 202MB hard disk, but the lack of an external processor cache may have hurt it slightly on our benchmark tests. You can get an external floppy disk drive or a relatively low-cost docking station that can handle two ISA cards, but unfor-

The ZEOS® Freestyle/SL Notebook is turning a few heads.

The only notebook with a tilt & swivel display. Great for sharing data or keeping it private. Easily adjusts for perfect viewing.

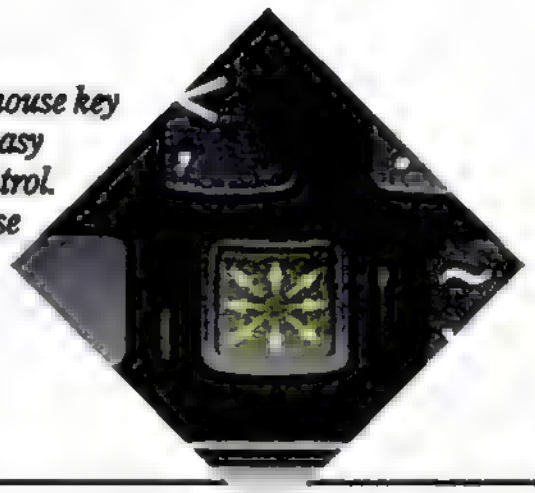
Including its own. And that's just for starters!

ZEOS has taken years of notebook experience and designed the perfect notebook. Feature for feature, there is simply nothing else like it.

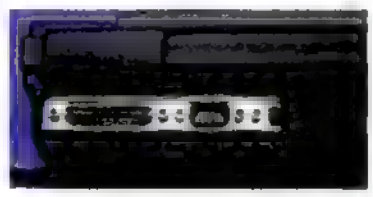
And because the ZEOS Freestyle/SL is designed and built by ZEOS we can offer it at prices that will send the competition reeling. Maximum features, minimum prices—it's the notebook you've been waiting for.

The ZEOS Freestyle/SL. Read all about it!

Built-in mouse key provides easy cursor control. Leave those bulky mice behind!



This sliding port door won't break off or come loose. Saves your fingers, too.



swivel display? Neither could we. So why not incorporate that feature into a notebook. With the ZEOS Freestyle/SL notebook you can adjust the screen left and right as well as tilt it up and down. Now you can truly adjust your notebook screen to the perfect viewing angle.

IT FLOATS TOO.

And then there is the "floating" screen. When you're facing your new ZEOS Freestyle/SL, the screen actually appears to "float" in the air in front of you. It's the only notebook that can really be used sitting on your lap!

EXTRA, EXTRA, EXTRAS. READ ALL ABOUT 'EM!

We've made more options available than ever before. Like our modem with send/receive fax. And memory up to 20MB, hard drives to 180MB, even an optional Italian leather carrying case! Extra batteries and a charging stand are available too. For all the details, call 800-554-7172.

ZEOS. #1 RATED NOTEBOOKS, SERVICE & SUPPORT!

Your new ZEOS Freestyle/SL is part of the same great ZEOS family of products that has won award after award for quality and service. In *PC Magazine's* recent Service and Reliability issue, ZEOS was the only vendor to receive the "Excellent Service and Reliability" rating for both desktops *and* notebooks!

And remember, ZEOS toll-free technical support is 24 hours a day, 365 days a year. And we back your new ZEOS Freestyle with our 30-Day Absolute Satisfaction Money-Back Guarantee, One Year Limited Warranty and more.

ORDER YOUR AMAZING ZEOS FREESTYLE/SL NOW!

Ordering your new ZEOS notebook is easy. Simply pick up the phone and give us a call. A friendly ZEOS Systems Consultant is ready to answer any questions you may have. You're going to love your new ZEOS Freestyle notebook!

CALL NOW TOLL FREE:

800-554-7172

Purchase orders from Fortune 1000 companies, governments and institutions are subject to approval. Leasing programs are available. All prices and specifications are subject to change without notice. Please call to confirm pricing, specifications and warranty details. All products and company names are trademarks or registered trademarks of their respective holders. ©1993, ZEOS International, Ltd., 1301 Industrial Blvd. Minneapolis, MN 55413 USA. ZEOS is a publicly traded company (NASDAQ symbol: ZEOS). X206-PCM-9303B

NEW ZEOS FREESTYLE/SL PACKAGE #1:

ONLY $1695

- Intel 25MHz 386SL, 64K cache!
- 2MB RAM standard, expandable to 20MB.
- 60MB hard drive, 3.5" floppy.
- Backlit 10" VGA display with tilt/swivel base. Simultaneous display with external VGA monitor.
- Snap-in and -out battery packs provide for 3-4 hours of typical operation.
- Quick-charge in little over an hour with the small lightweight AC adapter.
- 8.5" x 11.3", 5.6 lbs., built-in soft carrying handle.
- 81-key keyboard with built-in full-size inverted "T" arrow keys.
- Serial, parallel and VGA ports with standard connectors protected by a durable, easy-to-use sliding door. No more broken doors or broken fingernails!
- Includes MS-DOS!
- 30-Day Money-Back Guarantee, complete ZEOS Customer Satisfaction Package.
- 24-Hour-a-Day Toll-Free Technical Support, 365 Days a Year.

PACKAGE #2:

ONLY $2195

- 6MB RAM.
- 120MB hard drive.
- Custom-fitted nylon carrying case.
- MS-DOS and Windows!

PACKAGE #3:

ONLY $2695

- 10MB RAM.
- 180MB hard drive.
- Custom-fitted nylon carrying case, extra battery, external charging stand.
- MS-DOS and Windows.
- 2400 bps modem with 9600 bps send and receive fax!

ORDER NOW TOLL FREE:

800-554-7172

Fax Orders: 612-633-1325
Government: 800-245-2449
GSA# GS00K91AGS5176
Hearing Impaired (TDD) Orders: 800-228-5389
Outside US and Canada: 612-633-6131
MasterCard, Visa, Discover, Am Exp, Z-Card.℠
Open 24 Hours a Day, 365 Days a Year!

Copyrighted material

Copyrighted material

Folded edge of the page

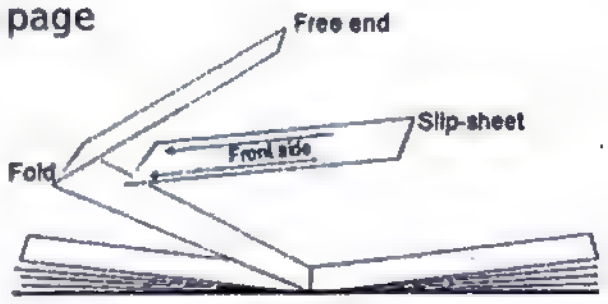
GbsSlipSheet-001

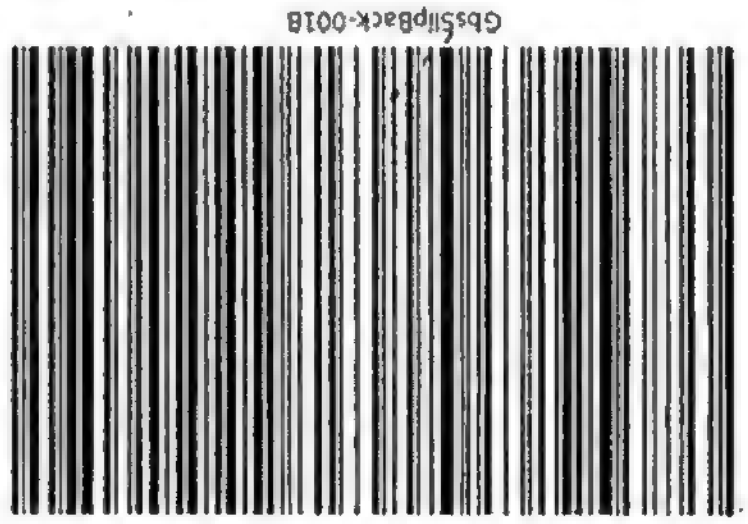
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



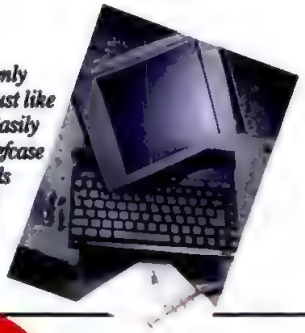


Back

1. Follow instructions on the other side

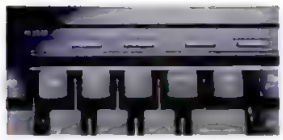
Inverted Back

1. Follow instructions on the other side



Measuring only 8.5" x 11.3" just like a notepad. Easily fits into a briefcase at 5.6 pounds yet packs all the wallop of a desktop!

Buy with confidence. ZEOS just won PC Magazine's *Readers' Choice for Service & Reliability (February 9, 1993). We're the only PC vendor to earn the "Excellent" rating for both our laptop and desktop systems!*



Digital brightness and contrast buttons make screen adjustment so easy.

NEW LOWER PRICE!

ZEOS® Freestyle/SL. More features at a lower cost than any other notebook.

To try and compare the ZEOS Freestyle/SL to any other notebook is next to impossible. Because nothing else has all its features. And even with all these great features, nobody can match the price. Features and price. It would seem the ZEOS Freestyle/SL is the best of all worlds. It is.

Period.

DESIGNED BY USERS. JUST LIKE YOU!

We asked our customers what it is they want in the perfect notebook. The first thing they told us is that most notebooks look like a cigar box with a lid. They told us they wanted not only good looks, but things like great power *and* great battery life. Lightweight too, like five pounds and change. And the keyboard should be effortless to use. The entire product had to be extremely durable. And that was just for starters.

2MB, 60MB Only $1695!

SL POWER. SL BATTERY LIFE. 64K CACHE!

We listened well. Then we got down to work. For the chipset and CPU we selected the Intel 25MHz SL. We then built in a high-speed 64K SRAM cache as standard. We know this system might well replace a desktop for many users.

And power to your ZEOS Freestyle/SL system is provided by our advanced battery system. The fully enclosed lightweight battery packs easily snap in and out and can be quick-charged when the system is not being used, or trickle-charged when in use. So what happens when the power is on?

GREAT VIDEO TOO.

You get great video! Because for video control, we chose the amazing new Cirrus Logic VGA controller. It not only consumes less power, it also produces the fast crisp images you're looking for. And with a business machine like this you'll also appreciate our dual display capabilities. You can connect an external VGA color monitor for simultaneous display. And that's not all.

A NOTEBOOK KEYBOARD YOU'RE GOING TO LOVE.

We re-designed and re-sculpted every key from scratch. Even the key-switch mechanism was invented anew. And we added the mouse key for easy cursor control. It is the absolute perfect notebook keyboard. What else?

Lots else! Like the best display system of any notebook available anywhere. We listened here too. The screen is big and easy to read. Plus, it's high contrast and it's fast. It's also very easy to adjust. People said contrast and brightness knobs were hard to use. So we replaced them with soft touch buttons that *electronically* adjust screen settings at your command. Then we really got creative.

THE ONLY NOTEBOOK WITH A TILT & SWIVEL DISPLAY.

Can you imagine your desktop PC without a tilt and

"Only ZEOS's portable PCs achieved significantly higher-than-average ratings in all four categories."

—PC Magazine, Service and Reliability issue, May 26, 1992

- ☑ **Overall PC reliability**
- ☑ **Future likelihood of buying from the vendor**
- ☑ **Satisfaction with repair service**
- ☑ **Satisfaction with technical support**

ZEOS® Notebooks #1 Again!

"Among laptop makers, Compaq Computer Corp. and ZEOS International sit alone at our highest level of reader satisfaction..."

—PC Magazine, Service and Reliability issue, Feb. 9, 1993

Get the ZEOS® Advantage.

24 hours a day, 365 days a year.

800-554-7172

Circle 152 on reader service card.

FACT FILE

BSI NB486DX2-50

Broadax Systems Inc., 9440 Telstar Ave., #4, El Monte, CA 91731; 800-872-4547, 818-442-0020; fax, 818-442-4527

List price (tested configuration): $2,150.

Tested configuration: 4MB 70-ns RAM, 202MB Western Digital WDAC2200 IDE hard disk with 64K buffer, DOS 5.0, Microsoft Windows 3.1, 1.44MB floppy disk drive, numeric keypad, carrying case.

Options: Trackball, $55; mouse, $15; docking station, $180; extra battery, $95; 9,600-/2,400 fax modem, $110; Ethernet adapter, $230; Token-Ring adapter, $575; external floppy disk drive, $250; external 120MB tape backup drive, $390; external 250MB tape backup drive, $480; external keyboard, $45; battery charger, $35; 12-volt battery adapter, $40.

In short: The BSI NB486DX2-50 is not perfect, but it has lots of processing power, a large hard disk, and fast performance for a pleasing price. Too bad it doesn't include an internal modem or battery.

495 ON READER SERVICE CARD

tunately there is no internal modem option. Lastly, though the power processor is a nice touch, it's obvious that BSI just stuck the next level of silicon into yesterday's case; leave this machine on for a while and it gets too hot to hold comfortably. Other companies like Texas Instruments have addressed this problem with low-heat motherboard chip sets or other engineering solutions.

Performance was more than competitive. The BSI placed first with its DOS-based disk and Disk Winmark scores. It also scored among the top ten on our processor, memory, and Graphics Winmark test routines. The battery lasted 1 hour 44 minutes on our Battery Rundown test and 2 hours 6 minutes on our ZDigit Rundown test. BSI could extend these times by improving the unit's power management, which at present revolve solely around LCD and hard disk time-outs.

BSI offers a one-year warranty on parts and labor.—*OR*

CAF Technology Inc.

CAF AquaLITE-II

With a standard array of components, which include the midrange AMD Am386SXL/25 processor, the $1,299 CAF AquaLITE-II has little to offer apart from its reasonable price.

The system produced a DOS processor score that landed in the bottom five, and most other scores were in the same range. The only exception was its DOS video score, which was just above average. That's an advantage only if you don't run Microsoft Windows, however, since you can't upgrade the CPU.

The results were not surprising, considering the system's internal guts. The CAF came with a standard 4MB of RAM and no external RAM cache. The video chip set is manufactured by VLSI Technology and is used by many off-the-shelf notebooks. The 80MB Conner hard disk's test results were quite low compared with the pack's.

The Sharp screen, also quite common these days, produced a clear, sharp image with slight bleeding; most annoying were four lines that dropped from the top to the middle of the screen. The controls are front-accessible.

CAF AquaLITE-II

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	FAIR
Windows applications	POOR
Desktop replacement	FAIR

The keyboard has a springy, bouncy feel, but the Enter key is almost half the normal size. This is frustrating for such a frequently used key. There are no separate F11 and F12 keys. A shortcoming of the CAF compared with most other machines is its lack of an integrated trackball; CAF does not sell a clip-on trackball as an option.

The matte gray case is solid, and all parts—including the hinged screen and the port doors—work with an impressive firmness. Power consumption is flexible, with options to shut off the screen and hard disk from 1 to 30 minutes. The Battery Rundown time of 2 hours 17 minutes is decent, and its ZDigit Rundown time of 3 hours 44 minutes was excellent.

The CAF comes with a one-year warranty, but there's no on-site service available.—*AC*

FACT FILE

CAF AquaLITE-II

CAF Technology Inc., 1315 Johnson Dr., City of Industry, CA 91745; 800-336-9369, 818-369-3690; fax, 800-329-2537

List price (tested configuration): $1,299

Tested configuration: 4MB 70-ns RAM, 80MB Conner CP 2084 IDE hard disk with 32K buffer, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1, nylon carrying case

Options: 2MB RAM upgrade, $154; 4MB RAM upgrade, $276; extra battery, $79; 2,400-/9,600-bps data/fax modem, $173; numeric keypad, $66; 12-volt battery adapter, $131.

In short: With average components, poor benchmark test scores, and no trackball, the CAF AquaLITE-II doesn't rise above the competition.

496 ON READER SERVICE CARD

Compaq Computer Corp.

Compaq Contura 3/25C

Based around a 386SL 25-MHz processor and toting a $2,499 list price, the Compaq Contura 3/25C is a step behind the offerings of the most cost-conscious vendors. In that contest, vendors like Broadax Systems and Polywell Computers are dressing primarily in 486 silicon. This portable does offer a more developed and streamlined package, however, and color.

The Contura's attractively priced passive-matrix color screen is better than most monochrome screens, but it is no match for an active-matrix screen. The company had to send us a replacement

Compaq Contura 3/25C

SUITABILITY TO TASK	
Road warrior comm	GOOD
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	FAIR
VENDOR SERVICE & RELIABILITY	
Overall Reliability	ABOVE AVERAGE
Repair Satisfaction	ABOVE AVERAGE
Tech Support satisfaction	ABOVE AVERAGE

portable after the original's screen died.

The 7-pound case has standard dimensions—a relief from the bulkier cases often used by smaller vendors. An internal 14,400/9,600-bps data/fax modem is available, as is an 80387 math coprocessor and up to 12MB of RAM. The 2.2-pound nickel hydride battery clicks easily and securely into a customized and streamlined drive bay, and the AC adapter brick is light and uncumbersome. The Contura 3/25C's documentation is satisfyingly complete and detailed, with plenty of illustrations and look-up tables. Power-management features include CPU, LCD, and hard disk time-out, standby, and hibernation modes.

Its processor and memory scores were on the low side, but remember that this is a 386 system competing against 486s. This portable managed a top-ten video score and an average Graphics Winmark score. Its battery lasted only 1 hour 57 minutes without power conservation (the 486s produced comparable results) and 3 hours 44 minutes with conservation.

Compaq offers its Conturas with a three-year parts-and-labor warranty that includes on-site service from its authorized service centers.—*OR*

FACT FILE

Compaq Contura 3/25C

Compaq Computer Corp., P.O. Box 692000, Houston, TX 77269-2000; 800-345-1518, 713-370-0670

List price (tested configuration): $2,499.
Tested configuration: 4MB 80-ns RAM with 64K external RAM cache, 85MB Conner Henshu IDE hard disk with 32K buffer, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1, trackball.
Options: 120MB hard disk, $649; 4MB RAM upgrade, $262; 8MB RAM upgrade, $526; Compaq mouse, $36; port replicator, $79; extra battery, $24-$121; 14,400-/9,600-bps data/fax modem, $649; math coprocessor, $246; external keyboard, $174; numeric keypad, $82; enhanced battery, $84; battery charger, $93; 12-volt battery adapter, $112; carrying cases, $14 to $122.
In short: The Compaq Contura 3/25C is outfitted with an acceptable 386-level processor. Its real selling point is passive-matrix color from a big-name vendor, at well below $3,000.
ON READER SERVICE CARD

Compaq Computer Corp.

Compaq LTE Lite 4/25C

The $4,099 Compaq LTE Lite 4/25C sports an excellent active-matrix color screen and a cleverly designed, easy-to-use integrated trackball. It is also the only reviewed system that uses an Intel 486SL/25 CPU.

The processor helped this portable score in the top third on most of our benchmark test suites and still turn in a Battery Rundown test score of 2 hours 6 minutes.

Compaq LTE Lite 4/25C

SUITABILITY TO TASK	
Road warrior comm.	EXCELLENT
DOS applications	GOOD
Windows applications	GOOD
Desktop replacement	GOOD
VENDOR SERVICE & RELIABILITY	
Overall Reliability	ABOVE AVERAGE
Repair Satisfaction	ABOVE AVERAGE
Tech Support satisfaction	ABOVE AVERAGE

The machine's power-management features include both DOS and Microsoft Windows access programs and a boot-time setup program. Power-conservation features include hard disk and screen shutdowns, four-level CPU speed control, system standby and idle modes, and a sleep mode.

At 8.4 inches diagonally, the Lite 4/25C's active-matrix color screen is 2 inches smaller than the IBM ThinkPad 700C's huge color screen, but offers a comparable image. The Compaq's display is very easy to read from all angles and produces sharp and bright images.

The Lite 4/25C uses the same ingenious built-in trackball found on the monochrome Compaq LTE Lite/25E. This screen-mounted pointing device with touch-distinguishable buttons on the back of the case cover allows for very easy one-handed on-screen cursor manipulation.

Priced about $1,100 more than the monochrome Lite/25E, the Lite 4/25C gives you faster performance, a bigger hard disk (120MB versus 80MB), and a superb color screen. There are other attractive active-matrix notebooks out there (notably the ThinkPad 700C), but the Lite 4/25C is the lightest and most impressive.—*Bruce Brown*

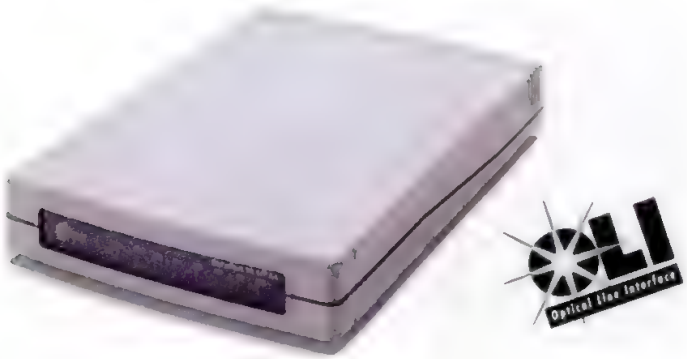
FACT FILE

Compaq LTE Lite 4/25C

Compaq Computer Corp., P.O. Box 692000, Houston, TX 77269-2000; 800-345-1518, 713-370-0670

List price (tested configuration): $4,099.
Tested configuration: 4MB 70-ns RAM, 120MB Compaq IDE hard disk, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1, integrated trackball.
Options: 4MB RAM upgrade, $369; 8MB RAM upgrade, $849; docking station, $599; port replicator, $79; extra battery, $187; 14,400-/9,600-bps data/fax modem, $679; external storage module, $281; external storage module with floppy disk drive, $393; external keyboard, $174; numeric keypad, $82; battery charger, $132; replacement AC power adapter, $132; 12-volt battery adapter, $93; CD-ROM adapter, $246; carrying case, $62; briefcase, $122.
In short: The Compaq LTE Lite 4/25C has a great color screen, a good design, and very good performance on our benchmark tests.
ON READER SERVICE CARD

LESS NOISE
LESS HASSLE
LESS MONEY



DataPort™ 14.4/Fax Modem with optical technology

MORE SPEED: Only AT&T's *exclusive* Optical Line Interface (OLI), pat. pending, eliminates the noise that other high-speed fax modems add to the data stream. Less noise means the highest speeds possible on good or bad phone lines!

MORE COMPATIBILITY: OLI delivers hassle-free compatibility for more consistent connectivity than other high-speed fax modems.

The DataPort 14.4/Fax Modem costs less, gives you much more!

- Optical Line Interface (OLI) pat. pend.
- V.32bis (14,400 bps data, 9,600 bps fax)
- V.42bis/MNP 5 (data compression error correction)
- Effective throughput up to 57,600 bps
- Lifetime warranty
- Lifetime toll-free technical support

$289 PC AT internal card

$299 PC AT XT or Macintosh external model

Comes complete with: QuickLink II comm. fax software for DOS and Windows or the Macintosh; CompuServe bonus ($22.95 value), user's manual and fax modem phone cord. Macintosh version also includes Mac cable.

MORE VALUE: You get everything you want in a high-speed fax modem, backed by AT&T's lifetime warranty and helpful, toll-free support. Special low prices, so hurry!

Solidly-built, solidly-backed by AT&T.

Visit your participating Computer City Superstore or Fry's Electronics. Or for the name of other dealers near you, or to order the DataPort 14.4/Fax Modem directly, call now: 1 800 554-4996 ext 2503.

Offer ends April 30, 1993. Visit the dealer nearest you, today!

Prices under $300 vary by dealer.

© 1993 AT&T Paradyne. DataPort is a trademark of AT&T. All other products or services mentioned here are the trademarks, service marks, registered trademarks, or registered service marks of their respective owners. Lifetime warranty is limited and applies to original purchaser only.

CIRCLE 323 ON READER SERVICE CARD

AT&T

Compaq Computer Corp.

Compaq LTE Lite/25E

The Intel 386SL/25–equipped Compaq LTE Lite/25E, which won an Editors' Choice in our issue of December 22, 1992, shows that Compaq Computer Corp. continues its tradition of building well-engineered portables. This $2,999 portable has a Hosiden active-matrix monochrome LCD panel, along with a clever built-in trackball and top power management, which helped it stand out among its competition.

Compaq LTE Lite/25E

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	GOOD
Windows applications	GOOD
Desktop replacement	GOOD
VENDOR SERVICE & RELIABILITY	
Overall Reliability	ABOVE AVERAGE
Repair Satisfaction	ABOVE AVERAGE
Tech Support satisfaction	ABOVE AVERAGE

The Lite/25E has the only active-matrix monochrome screen in a portable PC on the market. Active-matrix technology obviates the need for frequent screen adjustment that most passive-matrix displays require. And when using an active matrix, viewers who aren't directly in front of the screen can still see the images clearly, a feat that's next to impossible with a passive-matrix monochrome unit. Also, the large screen ensures a pleasantly large viewing area.

A second outstanding feature found in the Lite/25E is Compaq's built-in EasyPoint integrated trackball. Like most trackballs, it doesn't have much roll resistance. But two of its features are unique: its placement on the lower right side of the vertical display panel, and its two trackball buttons, located right behind it, on the outside of the case. They are shaped differently from each other, making them easily distinguishable via touch. This unusual system works well.

The Lite/25E's benchmark test scores were average, except for its top-five video score. Its battery life was relatively good, at 2 hours 59 minutes on our Battery Rundown test; its extensive power-management features helped it last 4 hours 12 minutes on our ZDigit Rundown test.

PC MAGAZINE EDITORS' CHOICE

FACT FILE

Compaq LTE Lite/25E
Compaq Computer Corp.,
P.O. Box 692000, Houston, TX 77269-2000;
800-345-1518, 713-370-0670

List price (tested configuration): $2,999.
Tested configuration: 4MB 70-ns RAM with 64K external RAM cache, 84MB Conner Henshu IDE hard disk with 32K buffer, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1, integrated trackball.
Options: 210MB hard disk, $699; 4MB RAM upgrade, $369; 8MB RAM upgrade, $846; trackball, $93; docking station, $599; with 1.2MB or 1.44MB floppy disk drive, $711; port replicator, $79; 14,400-/9,600-bps data/fax modem, $679; external keyboard, $174; numeric keypad, $82; battery charger, $87; replacement AC power adapter, $132; 12-volt battery adapter, $93; SCSI interface, $139.
In short: An excellent active-matrix monochrome screen and good system design make the Compaq LTE Lite/25E highly recommendable.
473 ON READER SERVICE CARD

If you don't require color but still want the best display possible, the Lite/25E is the only choice.—*BB*

CompuAdd Computer Corp.

CompuAdd 425C

PC Brand Inc.

PC Brand 486/SLC Color LeaderBook

Two almost-identical notebooks—the $2,495 PC Brand 486/SLC Color LeaderBook and the $2,595 CompuAdd 425C—offer standard components at a moderate price. Manufactured by Taiwan-based Compal, both have a Cyrix Cx486SLC/25 CPU, measure 1.8 by 11 by 8 inches, and weigh 5.9 pounds. However, there are some important differences, notably in the screen and the chip set.

The PC Brand Color LeaderBook has a backlit passive-matrix LCD made by Sharp. It is readable from almost every angle and has full-screen graphics support that can be reduced to text mode by changes in setup. The CompuAdd 425C has an edgelit passive-matrix LCD made by Sanyo. It is a little smaller than and not quite as good as the Sharp-made screen, and is hard to view from the front and nearly impossible from an angle.

Both machines have a built-in trackball just above the rightmost keys; some users might find the placement of the buttons on the right side of the machine a bit awkward. The keyboards are identical and slightly cramped, with a right Shift key that is too small and easily missed if you're a fast typist.

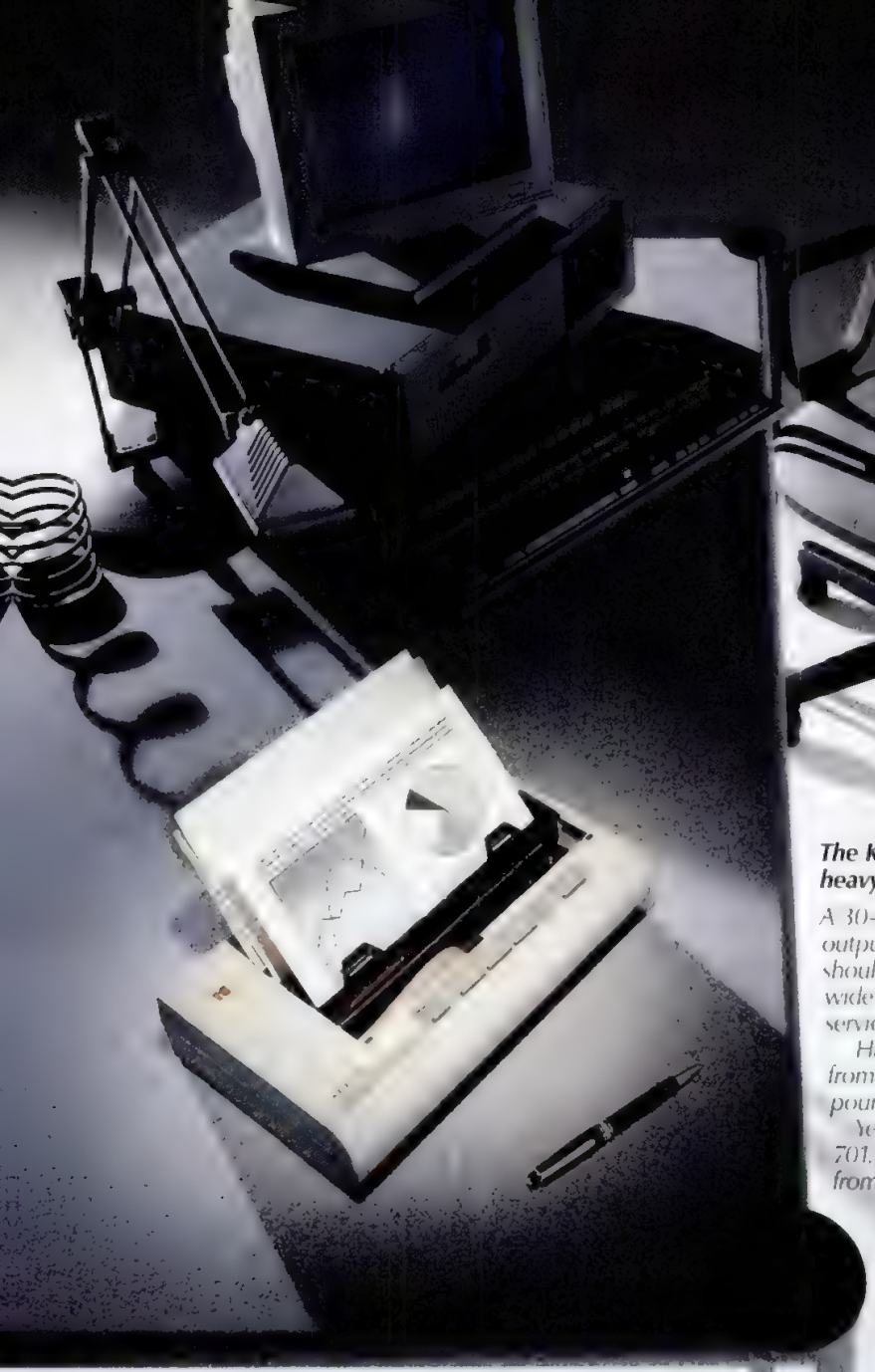
The biggest difference between the two motherboards is the chip set. The PC Brand has a Chips & Technologies F82C711 chip set; the CompuAdd, a Chips & Technologies F82C310. Since the F82C711 chip set boosts the I/O functions, the PC Brand system can accommodate an optional expansion unit. An expansion port located on the portable's bottom rather than on its back eliminates the need for a cable and lets it plug directly into the docking station. The C&T chip set also helped the PC Brand unit produce a better processor score than the CompuAdd's.

CompuAdd 425C

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	FAIR
VENDOR SERVICE & RELIABILITY	
Overall Reliability	AVERAGE
Repair Satisfaction	AVERAGE
Tech Support satisfaction	ABOVE AVERAGE

The CompuAdd comes standard with a Cyrix math coprocessor. Both machines require the same procedures for upgrading memory. While experienced users might be able to do the upgrade themselves, both vendors recommend sending the computer back to the factory.

The battery life for both computers ranged from average to poor. The PC Brand unit averaged 1 hour 53 minutes on our Battery Rundown test. The Com-



PC MAGAZINE EDITORS' CHOICE
August 1992
Kodak Diconix 701 Printer

The KODAK DICONIX 701 Printer. It's no heavyweight until you consider all it comes with.

A 30-page built-in sheet feeder. 300 dpi laser-quality output. A new three-year warranty. And, should service be required, a nationwide network of authorized service agents.*

Hardly the features you expect from a printer weighing in under six pounds.

Yet exactly what you get with the KODAK DICONIX 701. The printer that gives you the quality you expect from a desktop. And the portability your job demands.

No wonder it was rated Editor's Choice by PC Magazine. And at a new suggested list price of only $479 (U.S.), the 701 is now more affordable than ever. (Dealer prices may vary.)

For more information about the 701 Printer, and the name of the dealer nearest you in the U.S. or Canada, call 1 800 344-0006.

The KODAK DICONIX 701 Printer. It's the lightest heavyweight you'll ever put on your desk. Or in your briefcase.

* [illegible] Kodak makes no other warranties, expressed or implied including implied warranties of merchantability and fitness for purpose

CIRCLE 362 ON READER SERVICE CARD

THE LIGHTWEIGHT WITH HEAVYWEIGHT PROTECTION.

KODAK DICONIX 701 Printer

THE KITCHEN SINK IS

If you're getting the feeling the T4500 series represents a new standard in business notebook computing, you're right.

Our T4500C features an LCD TFT active matrix color screen that can display a kaleidoscope of 256 simultaneous colors from a palette of 185,193. Our T4500 offers a large, bright, easy-to-read 9.5" VGA display with 640 x 480 resolution and 17:1 contrast ratio.

A 150-pin expansion port lets you attach a SCSI adapter to the notebook. Or lets you attach the notebook to our Desk Station IV, providing true desktop capabilities in your office.

System control hotkeys save time by allowing you to quickly change your display setting, power management, security status, etc., without having to call up menus.

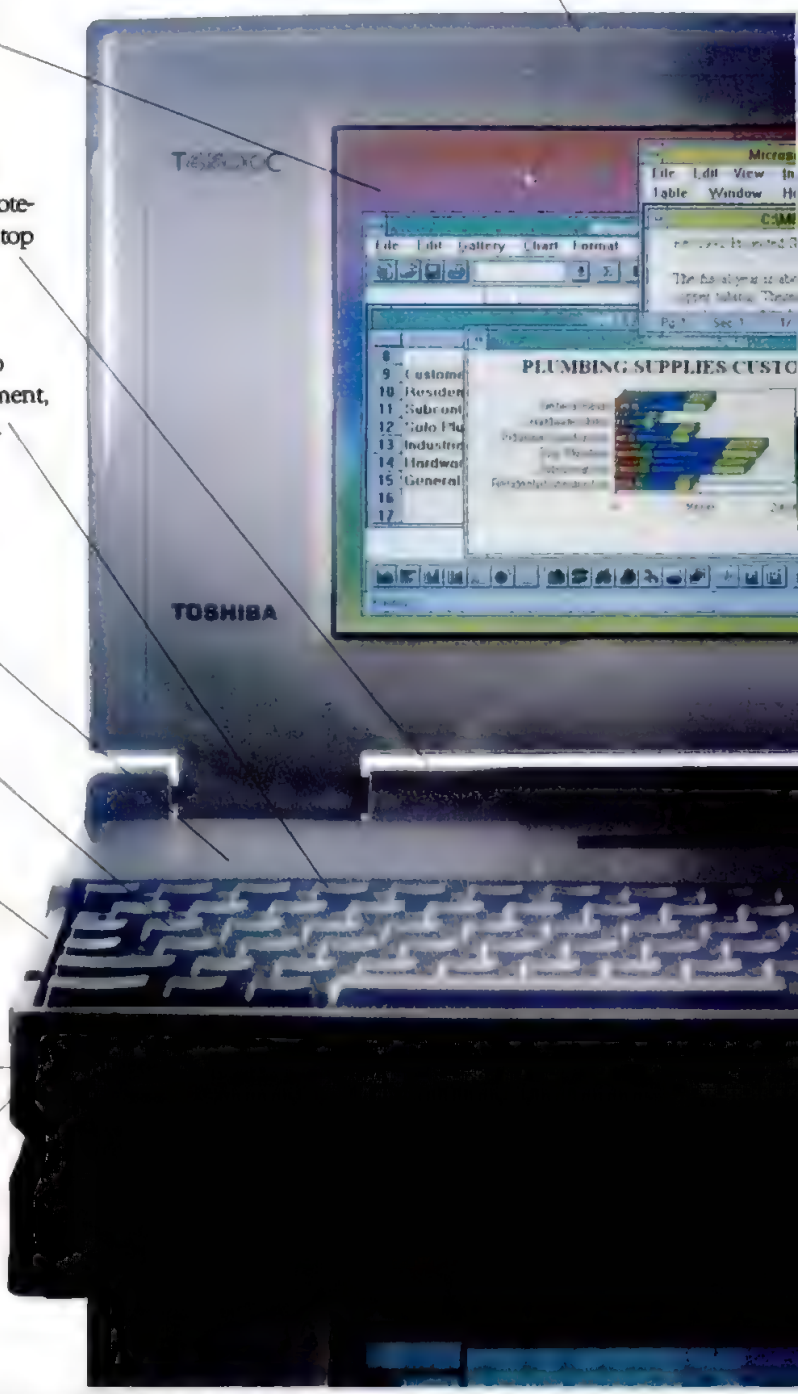
A generous 4MB RAM standard, expandable to 20MB.

Our award-winning keyboard features standard-sized keys and key spacing.

The T4500 series' advanced 20MHz i486™SX processor makes any 386 seem like a tortoise. In fact, tests reveal it's up to two and a half times faster than many 386-based notebooks.

The T4500C comes with a 120MB hard drive and our T4500 comes with a choice of an 80MB or 120MB hard drive.

3.3-volt chip technology decreases power drain by as much as 25%, while adding up to 27% more battery life.



INTRODUCING THE

© 1993 Toshiba America Information Systems, Inc. The Intel Inside logo and i486 are trademarks of Intel Corporation. All products indicated by trademark symbol are trademarked and/or registered by their respective

OPTIONAL.

The T4500C's dimensions: 11.7"W x 8.3"D x 2.0"H.
The T4500's dimensions: 11.7"W x 8.3"D x 1.8"H.
Both fit into half of a briefcase.

Windows® 3.1 and DOS® 5.0 with Ultrafont™ come pre-installed.

AutoResume lets you start where you left off without rebooting and automatically saves your material when you turn the power off.

Our Quick Charge capabilities allow you to charge the battery while you're working.

Featuring AutoResume, AutoSave, Advanced Power Management, and CPU Sleep Mode, our MaxTime™ power management system helps you get the maximum out of every battery charge.

Quickread LCD status icons allow you to check a host of functions (including remaining battery time, keyboard status, and power-saving mode) at a glance.

An industry-standard PCMCIA 2.0 slot accepts removable hard drives, data/fax modems, network adapters, and other expansion options.

The BallPoint™ mouse connects directly to the computer through a unique "one touch" QuickPort,™ so there's no cord to get in your way.

A front-loading floppy drive provides easy access.

Both the T4500 and the T4500C weigh in at about 6.5 lbs.

The T4500 features a large, easy-to-read 9.5" monochrome screen.

Tests reveal that the 3.3-volt 20MHz i486™SX processor is up to two and a half times faster than many 386-based notebooks.

You can call real-live Toshiba technicians toll-free for complete product support.

intel inside

In Touch with Tomorrow
TOSHIBA
1-800-457-7777

TOSHIBA T4500 SERIES

manufacturers

CIRCLE 379 ON READER SERVICE CARD

puAdd fared slightly better on the same test, averaging 2 hours 11 minutes. Both machines were unable to run our ZDigit Rundown test because this test interfered with their screen-blanking routines. Both machines come with two batteries, each of which takes 4 hours to recharge.

PC Brand 486/SLC Color LeaderBook

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	GOOD

PC Brand's 108-page user manual was comprehensive and very helpful, serving as a good reference work; the 23-page booklet that came with the CompuAdd did not cover enough territory.

Both the PC Brand and CompuAdd

FACT FILE

CompuAdd 425C

CompuAdd Computer Corp., 12303 Technology Blvd., Austin, TX 78727; 800-627-1967, 512-250-1489; fax, 512-331-6236

List price (tested configuration): $2,595.

Tested configuration: 4MB 80-ns RAM, 85MB Seagate ST9096A IDE hard disk with 64K buffer, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1, nylon carrying case.

Options: 122MB IDE hard disk, $200; 8MB RAM upgrade, $349; mouse, $119; extra battery, $75; 2,400-/9,600-bps data/fax modem, $129; Ethernet network adapter, $355; 12-volt battery adapter, $99; external keyboard cable, $9.95; portable printer, $349; sound adapter, $150; Solidex carrying case, $69

In short: The CompuAdd 425C has a poor battery life on our benchmark tests and an LCD panel that isn't as crisp as the PC Brand's. It does have in its favor a decent processor at a price that includes a Cyrix math coprocessor.

474 ON READER SERVICE CARD

Traveling Trackballs

We look at substitutes for the common field mouse.

Today's high-end portables are sporting an ever-increasing variety of integrated pointing devices; for example, the IBM ThinkPad 700C has the eraser-like TrackPoint II in the center of its keyboard, and the Compaq LTE Lite 4/25C and Hyundai Courier Spectra have mini-trackballs built into their cases.

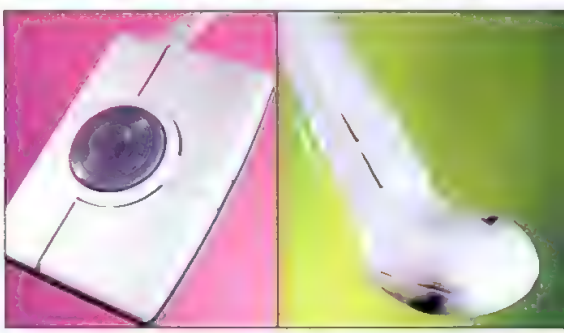
Mounted trackballs sans cords, like the Microsoft BallPoint with QuickPort connection, and the DECpc 325SL's front-attached trackball, have crossed the line from cumbersome to compact. However, until every original equipment manufacturer has latched on to the trend, we'll continue seeing a variety of separate pointing devices bundled with portables.

In this roundup of 12 portable pointing devices, we'll check out new twists and old standbys. The newest is the PortaPoint (Interlink Electronics, 1110 Mark Ave., Carpinteria, CA 93013; 800-477-3535). This touch button has no visible moving parts, weighs 2 ounces with its cable (making it the lightest pointer in this review), and costs $79—less expensive than many bulky trackballs. Finger pressure on a rubber disk moves the cursor, allowing for full 360-degree control. Two mouse buttons partially surround the disk on the bottom half of the 1.8- by 2.6-inch stationary casing.

While pointing is easy, "painting" with the PortaPoint is not always a simple task; this Microsoft mouse–compatible device is better suited to triggering icons and buttons. Its only drawbacks were the need for a PS/2 adapter (which was included with the test unit) and a short, 27.5-inch cord. A spokesperson for the company said a 48-inch extension cable will be included with future units.

The $69.95 IMSI PC Stylus provides excellent control over detailed graphics (IMSI, 1938 Fourth St., San Rafael, CA 94901; 800-883-8082). The 6.5-inch PC Stylus requires only about a square inch of flat workspace, and its mouse button is conveniently located where your index finger rests. When used as a trackball, however, its mini-ball feels loose and can be difficult to maneuver. The PC Stylus has a three-year warranty, Microsoft Mouse compatibility, and a 69-inch cord. New PS/2-compatible and serial versions of the PC Stylus were to be released in mid-February.

The $79.95 Microtrak is bigger than most trackballs, but well designed (Kraft Systems Inc., 450 W. California Ave., Vista, CA 92083; 619-724-7146). With a customizable 10- to 1,150-dpi (dot-per-inch) resolution, this trackball had the best response of the group. The



Interlink Electronics' PortaPoint — The IMSI PC Stylus

MicroSpeed MicroTRAC — Appoint Thumbalina

Photographs by Thom O'Connor

Microtrak is truly plug-and-play and Microsoft Mouse compatible. Nevertheless, the Microtrak does have a few hang-ups: It's easy to click both mouse buttons simultaneously, its clamp is not fully adjustable, and it lacks a PS/2 adapter. The $99.95 ICONtroller is a relatively light alternative (Suncom Technologies, 6400 W. Gross Point Rd., Niles, IL 60714; 708-647-4040). The convenient mouse button at the tip of the joystick reduces the amount of thumb calisthenics you'll have to endure, and when your work is done, the ICONtroller adds a new dimension of fun to flight simulators.

Other favorable performers in the portables arena are the $89 MicroTRAC, with its coiled cable and colorful replacement balls (MicroSpeed Inc., 5005 Brandin Ct., Fremont, CA 94538; 800-232-7888); and the 1.6-inch-square $99 Appoint Thumbelina and her cousin, the $99 MousePen Pro, Version 2.0 (Appoint, 4473 Willow Rd., #110, Pleasanton, CA 94566; 800-448-1184). Each of the Appoint devices weighs less than an eighth of a pound.

With a selectable 50- to 9,600-dpi resolution, the MicroTRAC comes with a top-level 15-inch-per-second tracking speed and the KeyMAP keyboard emulator.

Appoint's evergreen Thumbelina is a very popular thumb-driven pointing device, primarily due to its lilliputian size, but clumsy hands may have a difficult time operating the tiny ball. As with Thumbelina, the MousePen Pro's 5-foot cord terminates in a PS/2 connector. A new version should be available shortly.

Although the other five trackballs are conveniently Microsoft Mouse compatible, their on-screen arrows can be hard to control. Despite sophisticated control panels and concise documentation, these units provided poor maneuverability, and none responded like the magnificent seven reviewed above.

- The $99.95 NewPoint trackball is shell-shaped, with the "right" mouse button located conveniently at the bottom point (Mouse Systems Corp., Fremont, California; 510-656-1117).
- The $79 Genius HiPoint sports a design identical to the NewPoint's and also includes several clamp plates of varying sizes for secure attachment (KYE International Corp., Ontario, California; 800-456-7593).
- The $169 Logitech TrackMan Portable Mouse, similar to Kraft's Microtrak, is rounder than the other reviewed devices (Logitech Inc., Fremont, California; 800-231-7717).
- The $69.95 DynaTrak clamps onto any laptop edge and has an extension swing arm for more flexible positioning (DynaPoint Inc. (formerly Z-Nix Co. Inc.), City of Industry, California; 818-854-6440).
- The $175 Microsoft BallPoint Mouse, the classic portable trackball, comes with a stand which can be adjusted to any angle (Microsoft Corp., Redmond, Washington; 800-426-9400, 206-882-8080).

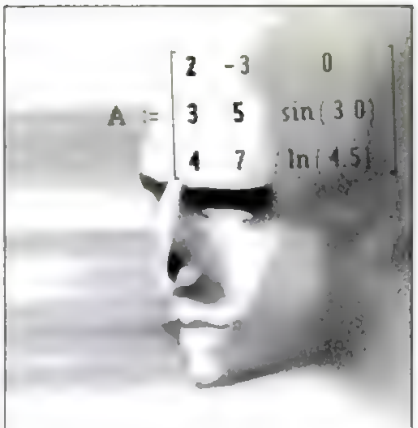
—Camille N. Cline

Kraft Systems' Microtrak

Suncom Technologies' ICONtroller

Appoint's MousePen Pro

Mouse Systems' NewPoint



COMPLETE MASTERY OVER TECHNICAL CALCULATIONS

New Mathcad® Version 3.1... Fast, Easy, Accurate

With new Mathcad Version 3.1, you'll do more math, more easily and communicate more clearly. It literally turns your computer screen into a "smart" math scratchpad.

- Writes and solves virtually any mathematical equation, numerically or symbolically.
- Easily prints out presentation-quality equations and graphics along with your explanatory text, to make you a more skilled communicator.
- Uses powerful Object Linking and Embedding (OLE) Client to directly interface with your spreadsheet, drawing, and word processing software.
- Allows "what if" calculating, so you derive better answers.
- Microsoft® Windows™ environment increases ease of use. Also available for Macintosh and UNIX.

Call **1-800-628-4223**
for more information and a free demo disk.
Or call
1-617-577-1017,
or fax the coupon below to
1-617-577-8829

❑ **YES!** Tell me more about Mathcad 3.1

Please send my FREE Mathcad 3.1 Information Kit and Demo Disk to the address below.

Disk Size ❑ 3 ½" ❑ 5 ¼"

Name _____
Title _____
Co./Inst. _____
Address _____
City/State/Zip _____
Phone (_____) _____

MathSoft Please mail this coupon to MathSoft, Inc., 201 Broadway, Cambridge MA 02139 USA
PCM82

CIRCLE 050 ON READER SERVICE CARD

FACT FILE

PC Brand 486/SLC Color LeaderBook

PC Brand Inc., 405 Science Dr., Moorpark, CA 93021; 800-722-7263, 805-378-7848; fax, 805-378-7801

List price (tested configuration): $2,495.

Tested configuration: 4MB 80-ns RAM, 80MB Seagate ST9144A IDE hard disk with 32K buffer, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1, trackball, nylon carrying case.

Options: 120MB hard disk, $200; 2MB RAM upgrade, $150; 4MB RAM upgrade, $300; docking station, $399; extra battery, $59; 2,400-/9,600-bps data/fax modem, $199; math coprocessor, $99; external keyboard, $59; numeric keypad, $40; battery charger, $15; 12-volt battery adapter, $15;.

In short: The PC Brand 486/SLC Color LeaderBook is an average machine at an average price. Notable options include a passive-matrix screen and an F82C711 chip set that extends I/O port capabilities. On the downside, this portable's battery life is poor.

475 ON READER SERVICE CARD

are average machines for an average price. In this case, the PC Brand offers more than the CompuAdd, for almost the same price.—*Michael Bonomo*

Ergo Computing Inc.

Ergo Modular Color 486SLC NoteBrick

Ergo Modular 486SLC NoteBrick

One of the first active-matrix color units to sport a sub-$4,000 price, the $3,993 Ergo Modular Color 486SLC NoteBrick is less expensive than other active-matrix color machines. Like its junior partner, the $2,493 monochrome Ergo Modular 486SLC NoteBrick, the Color 486SLC has most of the same components except for the screen.

The color notebook's biggest asset is its superb screen. Made by Sharp, the crystal-clear 9-inch active-color display makes running Microsoft Windows on the road a real pleasure. The monochrome version has a backlit LCD screen made by Sanyo. Both units have the same refresh rate at 800-by-600 resolution and use the Cirrus Logic 6410 video chip set.

Windows fans will encounter a roadblock in the color unit's performance, however: A weak Graphics Winmark score put it in the bottom 10 percent of the review group, though its DOS video score was above the mean. Unfortunately, its other test scores were also low: It scored last on our two disk test suites and on the overall DOSmark, although its processor and memory scores were a shade below the average. The monochrome version performed a tad better overall than the Color NoteBrick.

Ergo Modular Color 486SLC NoteBrick

SUITABILITY TO TASK	
Road warrior comm.	FAIR
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	FAIR

Both machines have a Cyrix Cx-486SLC/25 processor and come standard with a Cyrix coprocessor, which should make them faster for certain calculation-intensive applications. However, the Cyrix's 1K internal cache was not enough; lack of an external cache accounted in part for its relatively slow processor and memory test results.

Ergo Modular 486SLC NoteBrick

SUITABILITY TO TASK	
Road warrior comm.	FAIR
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	FAIR

Both of these systems are well-built, and both come with a dark, heavy-duty case in either a matte or smooth finish. The full-size keyboard has 84 keys with separate F11 and F12 keys; the PgUp/PgDn keys are a bit small and sit in a row on the right.

Both units have the trackball on the left side toward the back—better for lefties, but awkward for others. Duplicate sets of trackball buttons—one next to the trackball and the other on the left edge—are a brave attempt to improve trackball placement, but neither set is very accessible. The expansion-minded can choose from four different modules that fit into the trackball slot: standard trackball, trackball/fax, RS232 serial port, or Ethernet adapter. The Ethernet adapter is a plus for corporate networkers who feel tied down by a bulky adapter sticking out the back of their portables.

When it comes to size and weight,

FACT FILE

Ergo Modular Color 486SLC NoteBrick

List price: $3,993.

Tested configuration: 4MB 70-ns RAM, 120MB Areal A-120 IDE hard disk with 32K buffer, 1.44MB floppy disk drive, 9,600-/2,400-bps data/fax modem, DOS 5.0, Microsoft Windows 3.1, trackball, carrying case.

Options: 4MB RAM upgrade, $300; 12MB RAM upgrade, $1,600; trackball, $99; 9,600-/2,400-bps data/fax modem, $249; trackball and 2,400-/9,600 data/fax modem, $299; extra battery, $129.

In short: The Ergo Modular Color 486SLC NoteBrick's superb color screen and good construction contend against slow graphics performance and a relatively short battery life.

Ergo Modular 486SLC NoteBrick

List price: $2,493.

Tested configuration: Same as for color unit.

Options: Same as for color unit.

In short: The Ergo NoteBrick monochrome unit lacks the superb screen that its color counterpart has but it performed slightly better on most of our benchmark tests.

Ergo Computing Inc., One Intercontinental Way, Peabody, MA 01960; 800-633-1925, 508-535-7510; fax, 508-535-7512

476 ON READER SERVICE CARD

"You mean I can order from IBM over the phone?"

intel inside

PS/ValuePoint™
433DX

i486™DX/33 MHz
120MB hard drive
8MB RAM
Pre-installed OS/2® 2.0 (with DOS and Windows™ built in)
6312 SVGA NI 14" color display'
3.5" diskette drive
IBM mouse
Internal i487™ math coprocessor
128KB L2 cache
8KB internal cache
1MB Video DRAM
Industry standard compatibility
Networkable
5 slots/5 bays

$1,999*

Welcome to IBM Direct.

PS/ValuePoint
466DX2

i486DX2/66 MHz
212MB hard drive
8MB RAM
Pre-installed OS/2 2.0 (with DOS and Windows built in)
6319 SVGA NI 15" color display[1]
3.5" diskette drive
IBM mouse
Internal i487 math coprocessor
128KB L2 cache
8KB internal cache
1MB Video DRAM
Industry standard compatibility
Networkable
5 slots/5 bays

$3,119*

PS/ValuePoint
325T

386SLC™/25 MHz
80MB hard drive
2MB RAM
Pre-installed DOS 5.0
PS/2® 8511 VGA color display
3.5" diskette drive
IBM mouse
5 slots/5 bays
IBM enhanced keyboard
Industry standard compatibility

$1,299*

"It's everything I need now...and Novell®-certified..."

"It's not just slots and bays... It gives me lots of choices. And that feels great."

"Three things hit me right off. Incredible power. Blazing speed. And getting a lot without paying a lot."

Every detail says IBM,

ThinkPad 300†

386SL/25 MHz
80MB hard drive
4MB RAM
DOS 5.0 pre-installed
Integrated STN LCD display
3.5" diskette drive

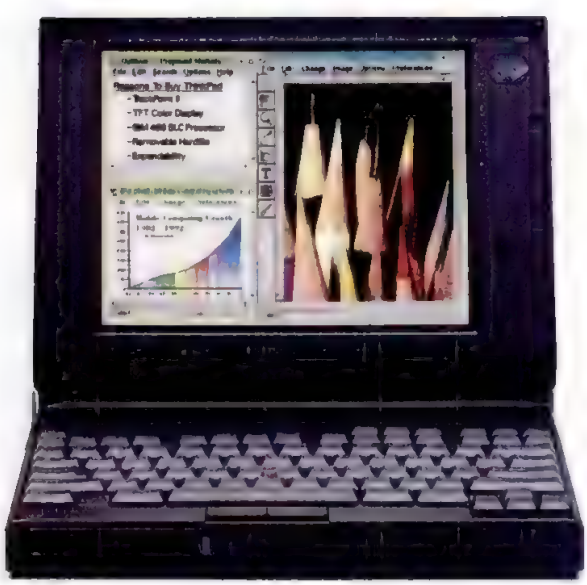
$2,335*

ThinkPad™ 700C†

486SLC/25 MHz
120MB hard drive
4MB RAM
DOS 5.0 and PRODIGY®†† pre-installed
10.4" active matrix color display
3.5" diskette drive
TrackPoint II,™ an integrated pointing device
Full-size keyboard, 84 keys
NiMH rechargeable battery pack
Removable hard disks
Slip-in IC DRAM cards for memory
Up to 16MB memory, system maximum

$4,139*

"No more mice scurrying around...This TrackPoint II is one hot little button."



"Wow! It's the biggest color screen I've ever seen."

IBM Direct

Buy IBM by phone.
Quality, service, selection and price–just call IBM Direct. It's that easy to get IBM PC products delivered right to your door. Or for more information on IBM products, call our automated fax system at 1 800 426-3395.

Choose the best way to pay.
Easy payment methods–American Express, VISA, MasterCard, Discover card or personal check. Personal checks are subject to credit approval. Purchase order is available for qualifying customers.

Hundreds of IBM products.
The IBM Direct catalog highlights a broad range of other products such as application software, storage devices, memory options, connectivity adapters and much more. In addition, our 40-page catalog features other IBM PS/ValuePoint and ThinkPad configurations. And if you want a PS/ValuePoint system with DOS and Windows only, that is also available on certain configurations.

The HelpWare™ Advantage.

- **One-year, on-site warranty for PS/ValuePoint products and ThinkPad 300.**
- **Three-year international warranty for ThinkPad 700 and 700C (in U.S., first year on-site).**
- **24-hour 800# assistance, 7 days a week[1]**
- **4-hour service response time, on average[2]**
- **24-hour Bulletin Board and Automated Fax**
- **Hassle-free, 30-day money-back guarantee[3]**
- **Plus 10,000 IBM service representatives at 1,600 locations backed by a $1 billion parts inventory**

[1] At no additional charge during warranty.
[2] Available Monday through Friday 8 am-5 pm in your time zone, when serviced by IBM. If parts are required, the service is provided after receipt of parts shipped overnight. Applies to IBM Direct sales only.
[3] Warranty and 30-day guarantee information available from IBM and IBM authorized dealers. Please call 1 800 426-2968 for details regarding IBM's money-back guarantee and limited warranty. Copies of the terms of IBM's money-back guarantee and limited warranty are available upon request.

* IBM prices only. The offerings, prices and products are subject to change or withdrawal without prior notice. Products you acquire may not be counted under any existing Volume Purchase Agreement. The same offerings and products may be available through IBM Authorized Remarketers. Remarketer prices may vary. Shipping and handling charges are extra.
† ThinkPad 300 and 700C systems and options are manufactured in Japan. PS/ValuePoint 6312, 6314 and 6319 Color Displays are manufactured in Korea.
†† PRODIGY will not run without a modem. A modem is not included with the ThinkPad 700C. A customer who acquires the ThinkPad 700C and a modem which operates at a speed below 9600 bps may contact Prodigy to obtain a One-Month Free Trial Membership.

When calling, please reference X213PCM1.

except the price.

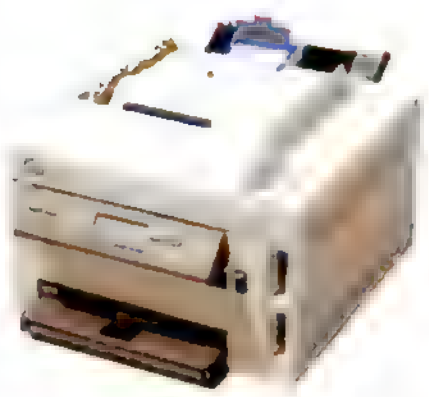
CALL TO ORDER TODAY
1 800 IBM 2YOU
1 800 426-2968 8am-9pm EST Monday-Friday

"And with one phone call I can get all this, too?"

You bet. And much more. This page offers just a sampling of the more than 250 advanced technology products IBM Direct offers to help you keep pace with your changing computer needs. From IBM desktops, ThinkPads and displays to adapters, peripherals, software, network connectors, even multimedia options. Just give us a call. We'll be glad to guide you to the IBM products most appropriate for your needs. We can also provide you with accurate specifications and answer any questions you may have.

Catalog
For handy reference and comparison shopping, the IBM Direct Catalog is a comprehensive source for a broad range of products available through IBM Direct.

Free



IBM LaserPrinter
An IBM LaserPrinter 6 delivers up to 6-pages-per-minute performance, 300 dpi resolution for sharp images, and a variety of built-in type fonts.

$1,510*

ThinkPad 700 and 700C Options	Price*
Data/Fax Modem (2400 bps/9600 bps)	$285
IBM PS/2 8MB IC DRAM Card	$905
IBM ThinkPad 486SLC2 Processor Upgrade	$549
ThinkPad 300 Options	
Data/Fax Modem (2400 bps/9600 bps)	$330
Port Replicator	$120
Operating Systems and Application Software	
DOS 5.0, Stacker V2.0 and 386MAX 6.0	$135**
OS/2 2.0, Upgrade from DOS	$ 99
WordPerfect® 5.1 for DOS	$355
Lotus® 1-2-3® for DOS	$355
Microsoft® Excel™ 4.0 for Windows	$335
Lotus Freelance Graphics® for OS/2	$425
Non-IBM programs are licensed under the manufacturer's, supplier's or publisher's terms and conditions	
**Promotional price. Offer good until 3/31/93. Offer may be modified or withdrawn at any time	
LAN Communications	
Token Ring Network 16/4 Adapter for AT Bus	$535
EtherCard PLUS Elite 16 Combo™	$195
PC LAN Program 1.3	$185
NetWare® V3.11 (5 User)	$720
IBM OS/2 LAN Server 3.0, Entry	$505
Printer and Printer Options	
IBM Personal Printer Series II, 2390	$385
IBM ExecJet® Printer, 4072	$775
500-Sheet Second Drawer for 4019(E), 4029	$295
PostScript® Option for 4019(E), 4029	$335
Technical support for IBM printers is provided by Lexmark™ International, Inc	
PS/ValuePoint Displays	
IBM 6312 Color Display	$405
IBM 6314 Color Display†	$530
IBM 6319 Color Display	$660

Expansion Unit (Docking Station)
The 3550 Expansion Unit for ThinkPad 700 and 700C gives you two slots and one bay, and accommodates 5.25-inch or 3.5-inch SCSI devices.

$859*

IBM OS/2, PS/2 and ExecJet are registered trademarks of International Business Machines Corporation PS/ValuePoint SLC, ThinkPad TrackPoint II and HelpWare are trademarks of International Business Machines Corporation

The Intel Inside Logo, i486 and i487 are trademarks of Intel Corporation Lexmark is a trademark of Lexmark International, Inc Windows and Excel are trademarks of Microsoft Corporation EtherCard PLUS Elite 16 Combo is a trademark of Standard Microsystems Corporation

Novell and NetWare are registered trademarks of the Novell Corporation PRODIGY is a registered service mark and trademark of Prodigy Services Company WordPerfect is a registered trademark of WordPerfect Corporation Lotus, 1-2-3 and Freelance Graphics are registered trademarks of Lotus Development Corporation. Microsoft is a registered trademark of Microsoft Corporation PostScript is a registered trademark of Adobe Systems Incorporated

©1993 IBM Corp

When calling, please reference X213PCM1.

IBM Direct

CALL TO ORDER TODAY
1 800 IBM 2YOU
1 800 426-2968 8am-9pm EST Monday-Friday

CIRCLE 066 ON READER SERVICE CARD

IBM®

these machines are roughly average for those reviewed here. The color system has a travel weight of 7.9 pounds, while the monochrome is a slimmer 7.5 pounds. But battery life tends to be short. The color unit has a rundown time of 1 hour 33 minutes; it lasted 2 hours 20 minutes on the ZDigit Rundown test, with power saving enabled. The monochrome unit had a rundown time of 2 hours 7 minutes and a ZDigit time of 2 hours 48 minutes.

Ergo covers its units with toll-free technical support and a 30-day money-back guarantee.—*AC*

Ergo Computing Inc.

Ergo Nifty Fifty 486/50 Color NoteBrick

With its 486DX2/50 processor and 120MB hard disk, the $4,145 Ergo Nifty Fifty 486/50 Color NoteBrick is certainly a power-packed portable. The only really important feature that differentiates it from the similarly equipped BSI NB486DX2-50, is passive-matrix color, though it comes at a $2,000 price.

Clear color graphics, fast number crunching, and up to 180MB of hard disk storage are in the Nifty Fifty's favor. The base-configuration price gives you a 120MB Areal hard disk; 180MB and 260MB units are options. Ergo Computing also bundles Addstor's SuperStor data compression software to double the hard disk capacity. The Nifty Fifty's exterior is attractive and sleek, and the internal nickel cadmium battery easily inserts into a secure housing. The system can internally display 256 colors in VGA and 16 colors externally in 1,024-by-768. The docking station holds two ISA expansion cards.

Ergo Nifty Fifty 486/50 Color NoteBrick

SUITABILITY TO TASK	
Road warrior comm.	FAIR
DOS applications	GOOD
Windows applications	FAIR
Desktop replacement	GOOD

Unfortunately, Ergo cut some corners, and it shows. The keyboard had slightly undersize keys. Adding memory or other internal options required opening the case and removing the keyboard. There are no internal modem options, which are critical for a system that advertises itself as meeting today's preferred level of performance. Also, after about 30 minutes to 1 hour of use, this system feels too warm to hold comfortably on your lap. Last, the Nifty Fifty's AC adapter brick is large and heavy, uncharacteristic of today's competitive notebooks.

Performance, on the other hand, was stellar. All its benchmark test scores except its video score placed in the top ten. The battery lasted a disappointing 1 hour 39 minutes on our Battery Rundown test and 2 hours 8 minutes on our ZDigit Rundown test.

Ergo offers buyers a 30-day money-back guarantee, a one-year parts-and-labor warranty and two-year coverage for the Areal hard disk, and an 800 number for technical support.—*OR*

FACT FILE

Ergo Nifty Fifty 486/50 Color NoteBrick

Ergo Computing Inc., One Intercontinental Way, Peabody, MA 01960; 800-633-1925, 508-535-7510; fax, 508-535-7512

List price (tested configuration): $4,145
Tested configuration: 4MB 70-ns RAM, 120MB Areal A-120 IDE hard disk with 32K buffer, 1.44MB floppy disk drive, Logitech mouse, DOS 5.0, Microsoft Windows 3.1, Cache86, SuperStor Pro 2.0, Xtree for Windows, carrying case
Options: 4MB RAM upgrade, $300; 12MB RAM upgrade, $1,600; expansion chassis , $495; extra battery, $179; external 9,600-/2,400-bps fax modem, $249; external 14,400-bps fax modem, $485; battery charger, $99
In short: The Ergo Nifty Fifty 486/50 Color NoteBrick is a passive-matrix color-processing powerhouse. However, shortcuts in the features set mean that only the truly power hungry should consider purchasing this portable

477 ON READER SERVICE CARD

Expo Tech Inc.

Expo Note 33

Like many lesser-known computers, Expo Tech's $1,237 Expo Note 33 has an adequate screen, standard components, and sturdy construction, and delivers these for hundreds of dollars less than its competition. Behind these low prices is Vtech, Expo Tech's parent company and one of Asia's largest electronics suppliers.

Expo Note 33

SUITABILITY TO TASK	
Road warrior comm	GOOD
DOS applications	FAIR
Windows applications	POOR
Desktop replacement	FAIR

But if price is not your only concern,

FACT FILE

Expo Note 33

Expo Tech Inc., 113 McHenry Rd., Buffalo Grove, IL 60089; 800-284-3976; fax, 800-947-3976

List price: $1,237
Tested configuration: 4MB 70-ns RAM, 60MB Seagate ST9077A IDE hard disk with 32K buffer, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1, carrying case
Options: 2MB RAM upgrade, $189; trackball and Microsoft Windows 3.1, $149.95, extra battery, $119, 9,600-/2,400-bps data/fax modem, $149; external floppy disk drive, $199.95, external keyboard, $39.95, replacement AC power adapter, $89.95; 12-volt battery adapter, $89.95
In short: The Expo Note 33 was hampered by a relatively slow processor and a small, 60MB hard disk. On the positive side are good battery life on our tests, a strong case, an adequate screen, and a dirt-cheap price

478 ON READER SERVICE CARD

performance may disappoint. In this test group, which included both 386- and 486-based machines, the Expo Note's AMD 386SXL/33 CPU placed near the bottom on our processor test suite. The relatively slow processing speed kept the Expo Note in the bottom third on almost every test suite except memory and DOS video, where it came out about average.

Battery times were good, however, registering 2 hours 46 minutes on the Battery Rundown test and 3 hours 16 minutes with power saving enabled on the ZDigit Rundown test. An interesting feature is the system-management interrupt under Microsoft Windows, which lets you return to a Windows program from suspend mode without rebooting.

Our test unit came with a 60MB Seagate Technology hard disk. Expo Tech plans to ship a 120MB hard disk later this year for $299 more. The sturdily constructed case weighs 8 pounds with battery pack and AC adapter. The Seiko screen creates a sharp picture, and the easily accessible controls give you more contrast and brightness than do most. The combined cursor/position keys are flawed: While the keys are large and have comfortable travel, you must press two keys to move around.

The Expo Tech system comes with a one-year warranty on parts; repairs are made within 24 hours of receipt.—*AC*

GRiD Systems Corp.

GRiD 1660C

GRiD Systems' GRiD 1660C has a fine active-matrix color screen, but its $4,795 price is a bit high for a 386SL/25-based notebook.

GRiD 1660C

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	FAIR
Windows applications	GOOD
Desktop replacement	FAIR
VENDOR SERVICE & RELIABILITY	
Overall Reliability	AVERAGE
Repair Satisfaction	AVERAGE
Tech Support satisfaction	ABOVE AVERAGE

The best feature of this moderate-size-and-weight notebook is its active-matrix color display manufactured by Sharp. The 8.4-inch screen is bright and easy to read from all angles; it also tilts back a full 180 degrees.

FACT FILE

GRiD 1660C

GRiD Systems Corp., 7 Village Circle, Westlake, TX 76262; 800-222-4743

List price (tested configuration): $4,795.

Tested configuration: 4MB 80-ns RAM with 64K external cache, 125MB Toshiba MK2124FCIDE hard disk with 64K buffer, 1.44MB floppy disk drive, 9,600-/2,400-bps data/fax modem, DOS 5.0, Microsoft Windows 3.1.

Options: 4MB RAM upgrade, $395; docking station, $695; extra battery, $189; 14,400-/9,600-bps data/fax modem, $795; battery charger, $500; 12-volt battery adapter, $115.

In short: The GRiD 1660C has a good screen and keyboard and a fairly decent battery life for an active-matrix color system, but unfortunately its 386SL processor and awkwardly placed trackball work to its disadvantage.

478 ON READER SERVICE CARD

Compared against a field that included 486s, the GRiD's 25-MHz Intel 386SL processor yielded generally slow benchmark test scores. The unit's processor scores landed in the bottom fifth, and its memory scores placed last. Its video score under DOS was closer to the average but still just below the mean. Its Graphics Winmark score fell in the bottom quarter. And while its disk score was better under DOS than under Windows, both disk scores were below the mean.

Battery life, however, was fairly good for an active-matrix color machine. The GRiD registered 1 hour 24 minutes on our Battery Rundown test, with power saving disabled, and 2 hours 48 minutes on our ZDigit Rundown test, with power saving enabled.

The trackball built into the GRiD is placed in the center of the machine past the keyboard; to use it, you have to reach across the keyboard. But except for the function keys, which are smaller, the keyboard features comfortable, full-size keys and good key travel.

The GRiD pales in comparison with other high-quality active-matrix color notebooks. Its screen and keyboard are enough to carry the system, but its comparatively slow processor and awkwardly placed trackball put it at a disadvantage compared with such systems as the similarly priced but faster and better-designed units from Compaq and IBM.

The GRiD comes with a one-year parts-and-labor warranty.—*BB*

Hyundai Electronics America

Hyundai Courier Spectra

Hyundai Electronics America has produced a credible competitor with its $2,999 Hyundai Courier Spectra. Built around a Cyrix Cx486SLC/25 processor, the Courier offers bright passive-matrix color and one of the most usable internal pointing devices we've seen. Its shortcomings include a lack of expandability and some below-average battery times.

The Courier Spectra unit comes with a slightly oversized, flocked-gray case. An internal modem is provided, as are all the requisite I/O ports, including external keyboard and PS/2 mouse ports. The 87-key keyboard is configured in a nonstandard format—all the function, Home, End, PgUp, and PgDn keys are arranged in multiple rows over the other keys—but all are full-sized, with nice travel and tactile response.

Hyundai Courier Spectra

SUITABILITY TO TASK	
Road warrior comm	GOOD
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	FAIR

The internal pointing device consists of a nicely sized trackball on the right side of the keyboard and two dedicated mouse activation buttons as part of the keyboard configuration. As long as you've got the Courier on a fairly stable work surface, this arrangement works well.

On a negative note, the first Courier that Hyundai sent us had a bad keyboard

THE UPGRADE DEAL OF THE CENTURY!

MICROSOFT OFFICE 3.0 for Windows

UPGRADE EDITION

4 of the most powerful productivity programs for Windows!

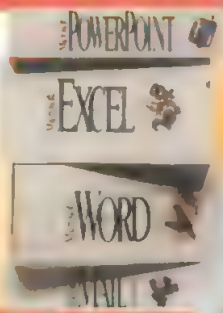
- **Microsoft Word 2.0**
  Windows word processing made easy!
- **Microsoft Excel 4.0**
  Spreadsheet power without the struggle!
- **Microsoft PowerPoint 3.0**
  For professional presentations!
- **Microsoft Mail 3.0**

IT'S EASY TO UPGRADE!

1 **If you own any word processor, spreadsheet, or presentation program** — from any publisher, any version, DOS or Windows — you pay only $349 for the Office 3.0 for Windows Upgrade!
That's more than a $400 savings off the retail price!

2 **If you own Microsoft Excel, Word (DOS or Windows), PowerPoint or Office 2.5 or earlier, you pay only $349 for the Office 3.0 for Windows Upgrade, PLUS** you'll receive a $50 REBATE direct from Microsoft (Rebate details are in the box.)
Your total purchase price for FOUR incredible programs is only $299!
Mail or fax your proof of ownership: title page of user's manual, original program disk, sales receipt or invoice
Available for a limited time

Ask for Item# SI0823 (3.5")
MicroWarehouse Low Price $349



All four programs $299*
*After Microsoft's Rebate

Includes Excel 4.0 & Word 2.0!

Aldus IntelliDraw

Aldus IntelliDraw defines an exciting new category of drawing program, with intelligent features that give you an easy, innovative way to visually experiment, refine, and draw your ideas. Intelligent tools link graphics in your drawing so they respond to changes automatically. Create visual "what if" scenarios with such features as intelligent clip art & templates, automatic symmetrical objects, and dimension lines. Auto-alignment, shape blending, powerful text handling capabilities, unlimited layers, color gradients, standard draw tools and more.
Publisher: Aldus
GR5383

$189.95

ManagePro 1.2 for Windows

"Top Product of '92" – *PC Week* "Best Product of 1992" – *PC Magazine* Windows 100." *PC Magazine* called ManagePro an "excellent tool for helping you become a better manager." Easily become more organized, achieve your goals and manage your people more effectively with three powerful, integrated tools. Finally, all your goal and people information is in one place! Plan, track and delegate goals with Goal Tools. Track progress, plan coaching and conduct reviews with People Tools. Take action with action tools, such as calendars. Enter information in simple spreadsheet style planners. ManagePro then automatically creates: color- coded goal and people status boards, timelines, action lists, calendars and reports.
Publisher: Avantos BS"513/5

$239

WinFax PRO 3.0

WinFax PRO 3.0 makes it easy to send, receive and manage faxes from within Windows. Send a WinFax PRO cover sheet like a Windows printer. Keep personal and business faxes organized and easy to find. Sophisticated [illegible] capabilities. Many [illegible] Create and edit [illegible] Import [illegible] Powerful [illegible] Supports most important Class 1 and 2 (Class 2.0) fax modems.
Publisher: Delrina Technology IN0334

$79

The UnMouse

The UnMouse does everything a mouse can—only faster, easier, and in less space. To move the cursor, simply slide your finger over the glass surface. To make a selection, merely press down. The UnMouse also serves as an extended keyboard. Tap the large red button and you have a Power keypad with 16 keys (60 in advanced mode) instantly available to execute macros. With its one million touch points the UnMouse also performs as a small graphics tablet.
Manufacturer: Microtouch
IN0810

$139

Typecase II

Typecase II is a versatile library of over 100 TrueType fonts that install seamlessly into Windows 3.1. Typecase TrueType fonts are scalable from 1 to 999 points and are compatible with every Windows-supported printer and monitor. This collection of state-of-the-art text, decorative and international symbol fonts is great as an addition to the original Typecase or as a stand-alone font library.
Also available: *Typecase* GR5433/5 $39.
Publisher: SWFTE
Typecase II GR5853/5

$39

I'm Kerry, call me at:

MicroWAREHOUSE

1-800-367-7080

Inquiries: 908-370-0518 Fax#: 908-905-5245
Order Toll-Free 24 Hours a Day, 7 Days a Week

Free Micro Warehouse Catalog Subscription
1720 Oak Street, P.O. Box 3014, Lakewood, N.J. 08701-3014
Fill out and mail this coupon to receive a free one year subscription to the MicroWarehouse catalog

Name

Address Apt.

City State Zip

(Expect to receive your next issue within 4-6 weeks)

CIRCLE 225 ON READER SERVICE CARD

MicroWAREHOUSE

WINDOWS COMPATIBLE

Call toll-free 1-800-367-7080

OVERNIGHT DELIVERY

ONLY $7.00

Item numbers ending in **3** and **5** denote products available in 3 1/2" and 5 1/4" formats respectively. Item numbers ending in **4** denote that both formats are included. Please refer to item numbers when ordering.

★ Windows-compatible products
◆ Call for available upgrades

Aapex Software
UT3243 ★Cursorific Professional 3.0 ..... 29.95
Ace Software
BS7303 ★AceFile 2.0 for Windows 99
Adobe
GR6513 ★Adobe Photoshop 2.5 for Windows 549.95
PR1594 ★Adobe Type Manager 2.0 59
GR5683/5 Adobe Typeset Value Pack 39
Agfa
GR5664 Desktop Styles 49
GR6344 Discovery TrueType Pack 49
Aldus
GR6683/5 ★◆Aldus PageMaker 5.0 ..... 589.95
GR5034 ★Aldus PhotoStyler 529
Altsys
GR5543 ★Fontographer for Windows ..... 265.
Amaze
EN3293 ★The Far Side Daily Planner 39.95
American Small Business Co.
CA0233 Design CAD 3D 4.0 249
Appoint
IN2260 Thumbelina 89.95
Approach Software
BS7374 ★◆Approach 2.0 for Windows 249.95
Ares Software
GR3074 ★FontMonger for Windows 89
Artisoft
NT0110 Lantastic 2 MBPS Adapter Card 149.95
AutoDesk
CA0173/5 Autosketch 3.0 89
AutoMap, Inc.
BS5224 AUTOMAP 50
Borland International
LN0563 Borland C++ 3.1 329
BS7183/5 ◆Paradox 4.0 ..... 539.95
BS7833 ★◆Paradox for Windows full upgrade 129.95
BS7813 ★Quattro Pro for Windows 99.95
LN0463/5 ★Turbo C++ for Windows 105
Broderbund
BS1834 PC Globe 5.0 43
EN0734 SimCity 29
ED0184 Where in the USA is Carmen SanDiego 32
Brown Wagh
EX1800 Sound Blaster Pro 189.95
Caere
IN2520 OmniPage Direct 269
FX0314 ★FaxMaster 99
GR2074 ★Omnipage Professional 549

Close-Up Dual Pack

PC Magazine "Editors' Choice 1992," Close-Up software lets you take control of PCs miles away by modem. Supports both DOS & Windows. Use Close-Up to run your office PC from home or on the road via laptop.

Publisher: Norton-Lambert
CM0503/5

$119

Calera
UT3154 ★FAXGrabber 1.2 65
Canon
PR1500/10 Bubble Jet BJ-10ex (White/Gray) 259
Central Point Software
UT3033/5 ★PC Tools Deluxe 8.0 ..... 119.95

★ImagePals 1.2

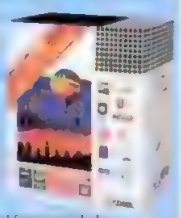
ImagePals provides a streamlined environment for publishing and presentation professionals. Organize images, graphics and application files into albums. Capture images from scanners, the screen and other input devices. Create eye-catching images using powerful editing tools. Then display your creations using the handy slide show feature. With file conversion and compression capabilities, ImagePals is a one-stop image and graphics solution.

Publisher: U-Lead
GR6463

$99

Chipsoft
TX0554 TurboTax 1040 1992 Final Edition 38.95
Claris
BS7294 ★◆FileMaker Pro 2.0 for Windows ..... 259.
Computer Associates
GR1823 CA Cricket Graph 1.3 85
FN0773 ★ACCPAC Simply Accounting 2.0 f/Windows 119
Contact Software
BS6954 ★ACT! for Windows 249
Corel Systems
GR5443/5 ★◆CorelDRAW! 3.0 ..... 389.95
Datastorm Tech.
CM0634 ★PROCOMM PLUS for Windows 99.95
DCA, Inc.
CM0664 ★Crosstalk 2.0 for Windows 89
Delrina Technology
FX0334 ★WinFax Pro 3.0 79
Digital Vision
EX1610 ComputerEyes Color/RT 469
Disks (boxes of 10)
BASF Sony, Maxell, KAO and bulk Fuji ..... Call
Fifth Generation
UT0724 Direct Access 5.1 65
UT2184 Fastback Plus 3.1 125
Fractal Design Corp.
GR5344 ★Painter 279
Generic Software
CA0074 Generic CADD 6.0 285
Genesis Integrated Systems
CD0840 GenStar 300I Int. MPC CD-ROM Kit 259
GFA Technology
CA0254 ★GFA CAD for Windows 99
Gold Disk
GR5763/5 ★ScreenCraze 2.0 for Windows 25
GR6194 ★Video Director for Windows 119
Hayes
MM2210 OPTIMA 96+ FAX96 ..... 379.95
MM2190 OPTIMA 144 + FAX144 ..... 499.95
MM2540 Accura 2400 External 85
Hewlett Packard
UT2894 ★Dashboard for Windows 45
IBM
UP0233/5 ◆OS/2 2.0 Upgrade DOS/Windows 95
Inset Systems
UT2414 ★HiJaak 2.1 for Windows 129
Intuit
FN0164 Quicken 5.0 43
FN0564 ★Quicken 2.0 for Windows 35
Iomega
DR2060 Bernoulli 90MB Cartridge One Pack 145.95
DR2240 Bernoulli PC Powered 499.95
DR2400 Iomega Tape 250 Insider 255.95
Kensington
AC0140 Masterpiece Plus 85
Leading Edge
CP0250 Color Notebook 60MB ..... 2499.
Logitech
IN1070 ScanMan 256 ..... 205.95
Lotus
BS6793/5 ◆Lotus 1-2-3 2.4 ..... 333.95
BS5253/5 ★◆Lotus 1-2-3 for Windows 309.95
BS7014 ★◆Lotus Ami Pro 3.0 ..... 229.95
BS6363/5 ★Smart Pics for Windows 69
Media Vision
IN2550 ProAudio Spectrum 16 ..... 205.95
Memory
SIPPS SIMMS DRAM ..... Call
MY0013 SIMM 1MB 100ns 55
MY0005 SIMM 1MB 70ns 61
MY0004 SIMM 1MB 80ns ..... 59.
Microcom
CM0674 ★Carbon Copy for Windows ..... 135.
Micrografx
GR2933/5 ★Windows Draw! ..... 99.
Microsoft
BS7553/5 ★◆Access 89
IN2150 Ballpoint Mouse 119
LN0543/5 ◆C/C++ Compiler 7.0 319
BS3253/5 ★◆Excel 4.0 for Windows 299.95
BS7743/5 ★◆FoxPro 2.5 for Windows 299.95
IN0890/B0 Mouse (bus/ser) 85.95
LN0603/5 ★Visual Basic 2.0 for Windows 99
WP0373/5 ★◆Word 2.0 for Windows 299.95
BS5324 ★◆Works for Windows 129.95
MicroSolutions
DR1240 Backpack 1.4 ..... 210.
MicroWarehouse
BN0960 386/SX 33 MHz w/Color Monitor ..... 999.
BN0970 486/SX 25 MHz w/Color Monitor 1299

★CorelDRAW! 3.0 CD-ROM Competitive Upgrade



A new Dream PC Graphics! CorelDRAW, winner of over 50 international awards, is the PC Graphics software for everyone. CorelCHART, CorelPHOTO-PAINT and CorelSHOW. CorelDRAW 3.0's enhanced features include graphic design layers, editable preview, improved 3D effects and powerful data-driven charting, paint and photo editing, and presentation packages. Other CorelDRAW! Upgrades available. Call.

Publisher: Corel Systems
SI0590

$199

Monitors
MT0500 Magnavox 17" Autoscan ..... 849.
MT0280 PanaSync C1381 14" VGA Color ..... 369.
Panasonic
PR2200 KX-P1124i Printer 299.95
Peachtree Software
FN0654 Peachtree Basic Accounting 6.0 ..... 75.
Persona Technologies
EX2060 PC Speakers 179.95
Polaris
BS2894 ★PackRat 4.1 ..... 259.
Practical Peripherals
MM2100 Practical Mod 14400FXSA V.32BIS Ext S&R 419

★Capitalist Pig™ for Windows

New! Animated business simulation game challenges you to build your own business under authentic economic conditions. Experience the challenge of business, scandals, fires, terrorists, and more, as you battle for billions or bankruptcy. Make crucial decisions every minute, and enjoy the results—or suffer the consequences. Capitalist Pig is the must-have "Game of the Year" for would-be entrepreneurs of all ages. You never knew business could be so simulating!

Publisher: Pluma Software
EN3663

$35

Prohance
IN2490 PowerMouse/100 99
Quadrangle Software Corp.
BS7433 ★A Place for My Stuff 79
Qualitas
UT0684 386MAX 6 61
Quantum Quality Productions
DR1250 HardCard II XL 105 MB 269
Quark
BN1153 ★QuarkXPress for Windows w/fonts 595.95
Quarterdeck Office Systems
EX1103/5 DESQ 386 6.0 61
BS1043/5 Desqview 386 2.4 with Manifest 129
Reference Software
WP0334 Grammatik 5 for DOS 55
WP0514 ★Grammatik 5 for Windows 55
Rupp Corp.
UT2644 ★FastLynx ..... 99.
Software Marketing
ED3734 Autoworks ..... 49.
Softkey Software
GR5494 Key CAD Complete ..... 39.
Software Publishing
GR2303/5 ◆Harvard Graphics 3.0 ..... 415.95
GR5063/5 ★◆Harvard Graphics for Windows 369
Stac Electronics
UT3094 ◆Stacker 3.0 99
SuperMatch
GR6354 ★VideoSpigot for Windows ..... 449.
Symantec
UT2183/5 ★◆Norton Desktop for Windows 115.95
UP0463/5 ★◆Norton Desktop 2.0 for Windows Competitive Upgrade 49.95
Targus
AC0670 Universal Notebook Case ..... 89.
Teac
DR0910 Teac 3.5 1.44 FD ..... 89.
Teleware
FN0413 ★◆M.Y.O.B. 3.0 for Windows 109.95
The Complete PC
FX0060 The Complete Communicator 3.0 299
The Software Toolworks
ED2563/5 ★World Atlas 3.2 for Windows ..... 45.
Touchstone
UT0734 CheckIt PLUS 85
Traveling Software
UT2074 ◆LapLink Pro 4.0 99
WordPerfect Corp.
WP1973/5 ★◆WordPerfect 5.2 for Windows 289.95
XTree Company
UT2783/5 ★XTree for Windows 69.95
Zoom Telephonics
MM0910 Fax/Modem FX 9624 S/R Ext. 99.95
MM2140 VFX V.32 BIS Ext. 14400 S/R Fax 239.95

Presentation Task Force CGM Clip Art 4.0

Now you can own the clip art *PC Magazine* recently called "The best CGM clip art package for overall quality and usability." Presentation Task Force CGM's thematic clip art packed to feature over 3,500 high quality color illustrations in one value-packed comprehensive volume! Use PIF clip art to enhance presentations, newsletters and spreadsheets created with over one hundred DOS and Windows applications including CorelDRAW! Designer, Harvard Graphics, Microsoft Publisher, PageMaker, Persuasion, PowerPoint, Quattro Pro, Ventura Publisher, Word for Windows, WordPerfect and many more! PIF clip art includes people, animals, business, symbols, musical illustrations, holidays, sports, military, and environment related images.

Publisher: New Vision Technologies, Inc. GR3174

$134.95

MicroWAREHOUSE®
1720 Oak Street, P.O. Box 3014, Lakewood, NJ 08701-3014
©1993 Micro Warehouse Inc.

- Visa and Mastercard accepted
- Your credit card will not be charged until your order is shipped
- Purchase orders subject to credit approval
- All products covered by 120 day ltd warranty * *Defective software replaced immediately. Hardware replaced or repaired at our discretion
- Connecticut, New Jersey and Ohio residents add appropriate sales tax
- Orders for in-stock items placed by 12:00 midnight (E) weekdays, (barring system failure, etc.) ship overnight by Airborne Express. (Some areas require an extra day)
- Shipping charge $7 per order up to 7 lbs. $1 per lb. above 7 lbs.
- UPS ground service also available upon request - $3 per order. UPS orders placed by 3:00p.m. (E) weekdays, ship same day
- Actual freight charges apply for computers, hard disks, Bernoulli's, tape backups, monitors, and printers
- Alaska, Hawaii, outside continental U.S., APO/FPO call for information
- Item availability and price subject to change without notice
- Software is not copy protected, except where marked by asterisk
- We reserve the right to limit quantities
- Please indicate disk size

©Copyright 1993 MicroWarehouse, Inc. MacWAREHOUSE® is a division of MicroWarehouse, Inc. MacWAREHOUSE® and MicroWarehouse® are registered servicemarks of MicroWarehouse, Inc. Item availability and price subject to change without notice.

FACT FILE

Hyundai Courier Spectra

Hyundai Electronics America, 166 Baypointe Pkwy., San Jose, CA 95134; 800-933-3445, 408-473-9200; fax, 408-473-9279

List price (tested configuration): $2,999

Tested configuration: 4MB 80-ns RAM, 124MB Areal A120 IDE hard disk with 32K buffer, 1.44MB floppy disk drive, 4,800-/2,400-bps data modem, carrying case

Options: 4MB RAM upgrade, $377; extra battery, $50

In short: Decent performance and bright passive matrix color at an affordable price are offset only by a lack of expansion possibilities and a short battery life

480 ON READER SERVICE CARD

and had to be replaced. The monochrome Courier 67500, never worked and wasn't replaced, so we excluded it from this review.

Below-average processor and memory scores were the work of the not-quite-a-486 Cyrix processor; DOS video and Graphics Winmark scores were also below the mean. But the Areal hard disk scored in the top ten on our disk test suite under both DOS and Windows. Battery times were poor considering the use of Cyrix's low-power silicon: 1 hour 11 minutes on the Battery Rundown test and 2 hours 35 minutes on the ZDigit Rundown test with power saving enabled.

Hyundai offers an 18-month warranty on parts and labor.—*OR*

IBM Personal Computer Co.

IBM ThinkPad 300

Somewhat overshadowed by the superimpressive, but more expensive, ThinkPad 700 models, IBM's $2,480 ThinkPad 300 is a cost-effective system with several well-designed features. The ThinkPad 300, which was designed and manufactured by Zenith Data Systems, has a 25-MHz Intel 386SX and a crisp, passive-matrix monochrome display. The 300 is an acceptable notebook with no glaring problems.

The ThinkPad 300's best feature is its 9.5-inch passive-matrix supertwist sidelit liquid crystal display. It provides very crisp characters and is easy to view as long as you look at it straight on; as with other passive-matrix screens, your view will suffer if you don't.

Battery life is another one of its strong points. The unit's time of 4 hours 18 minutes on our Battery Rundown test was the best in this roundup. Multiple power-management features extended its time to 5 hours 9 minutes on our ZDigit Rundown test, also the best in this group.

IBM ThinkPad 300

SUITABILITY TO TASK	
Road warrior comm	GOOD
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	GOOD
VENDOR SERVICE & RELIABILITY	
Overall Reliability	AVERAGE
Repair Satisfaction	AVERAGE
Tech Support satisfaction	ABOVE AVERAGE

The power-conservation features allow a wide range of time intervals for LCD and hard disk shutdown. In addition to a system-rest mode and a CPU slowdown mode, the 300 has a configurable power-off warning that gives you a chance to keep the system running in case you inadvertently turn it off.

The 300's keyboard is acceptable but unexceptional. It has separate cursor and page-movement keys, but you must use an Fn key for some system functions. The 300 has neither a built-in pointing device nor a removable hard disk, a feature included with the 700 models.

With its good screen and above-average battery life backed by flexible power management, the 300 is a decent, albeit unexciting, choice.

IBM offers a one-year parts-and-labor warranty.—*BB*

FACT FILE

IBM ThinkPad 300

IBM Personal Computer Co., Rte. 100, Somers, NY 10589; 800-772-2227; fax, 800-426-4329

List price: $2,480

Tested configuration: 4MB 70-ns RAM with 64K external cache, 80MB Conner CP-2084 IDE hard disk with 32K buffer, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1, mouse

Options: 120MB hard disk, $975, 2MB RAM upgrade, $245, 8MB RAM upgrade, $795, port replicator, $125, extra battery, $175; 2,400-/9,600-bps data/fax modem, $365, Ethernet network adapter, $125, numeric keypad $80, replacement AC power adapter, $145, OS/2 2.0, $195, TFT color upgrade, $3,045, charging cradle, $80, carrying case, $80

In short: The entry-level IBM ThinkPad 300 (made by Zenith) is an acceptable notebook computer with a better-than-average passive-matrix monochrome screen and an excellent battery life

481 ON READER SERVICE CARD

IBM Personal Computer Co.

IBM ThinkPad 700
IBM ThinkPad 700C

It took the IBM Personal Computer Co. years to produce a competitive portable computer, but now its new IBM ThinkPad 700 and IBM ThinkPad 700C are two of the finest notebooks on the market.

The monochrome ThinkPad 700 ($2,950) and the color ThinkPad 700C ($4,825) share a number of key elements. Each has the same responsive 84-key keyboard that makes all user functions

IBM ThinkPad 700

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	FAIR
Windows applications	GOOD
Desktop replacement	GOOD
VENDOR SERVICE & RELIABILITY	
Overall Reliability	AVERAGE
Repair Satisfaction	AVERAGE
Tech Support satisfaction	ABOVE AVERAGE

State of the Slate: *Pen-based Computers*

Today's pen computers are lighter and do more, but applications lag.

When George Bernard Shaw said, "We learn from experience that men never learn anything from experience," we know he couldn't have been speaking of pen computing, because neither it nor the electronic computer had been invented. But his remark couldn't have been more prescient about the early pen computer's legacy of hype and failure.

Today's pen-based computers from Dauphin, EO, Fujitsu, IBM, NEC, and Toshiba break the mold by being lighter and more powerful, and by employing new technologies like PCMCIA sockets, better digitizers, backlights, low-voltage components, and more and larger storage options. This current crop may show that makers of pen-based PCs have finally learned their lesson.

This group of pen-based computers and tablets represents the first generation of real-world systems, including entries from Dauphin, EO, Fujitsu, IBM, NEC, and Toshiba.

SMALLEST AND LIGHTEST

Measuring 9 by 5.7 by 1.2 inches and weighing 2.5 pounds, the $2,500 (estimated) Dauphin DTR is a powerful computer packed into a little case. It uses the Cx486SLC/25 CPU, has standard serial, parallel and keyboard ports, and includes an internal modem; Ethernet support is optional. Although its screen measures only 6 inches diagonally, the Dauphin has a VGA connector that can support a simultaneous external monitor at 1,024-by-768.

The Dauphin will come with DOS and Microsoft Windows for Pen Computing, and while the internal HP Kittyhawk hard disk holds a meager 21MB, the Dauphin has an external IDE connector that can also be used with Dauphin's DynaDrive, an external hard drive with removable disks. An external floppy disk drive is optional.

▶ **FACT FILE**

Dauphin DTR

Dauphin Technology Inc., 377 E. Butterfield Rd., #900, Lombard, IL 60148; 800-782-7922, 708-971-3400; fax, 708-971-8443.

List price: *$2,500 (estimated).*

THE COMMUNICATOR

EO's Personal Communicators are the only machines in this group that don't use an Intel-compatible processor. Powered by AT&T's Hobbit CPUs, the model 440 and model 880 run the PenPoint operating system. The model 440 weighs 2.2 pounds and holds 4MB of RAM (expandable to 12MB), a microphone and speaker, and PenPoint and nine applications. All this fits into a 10.8- by 7.1- by 9-inch case and costs $1,999 with 4MB of RAM. The Kittyhawk hard disk is optional.

The 13- by 9- by 1.1-inch model 880 is larger, weighs 4 pounds, and provides more versatile features and equipment. It costs $1,000 more (with 4MB of RAM installed) but comes with an internal modem and PCMCIA sockets, along with SCSI II, VGA, parallel, serial, and keyboard ports. Since EO is targeting the line for, well, communications, both computers have a port to connect an optional cellular telephone/modem module.

Photograph by Robert Cardin

▶ FACT FILE
EO Personal Communicator 440,
EO Personal Communicator 880
EO Inc., 800A E. Middlefield Rd., Mountain View, CA 94043; 415-903-8100; fax, 415-903-8190.
List price: *Model 440, $1,999; model 880, $2,999.*

TABLETS, LARGE AND SMALL

The $2,295 Fujitsu DecisionPoint uses AMD's 3.3-volt 25-MHz Am386SXLV processor to power the 3-pound, 11.7- by 8.7- by 1.2-inch tablet. With a 9.4-inch screen, 4MB of RAM, two PCMCIA Type III sockets (designed to accept solid-state or rotating-media hard disks), the Fujitsu system is small and powerful. It has parallel and serial ports, keyboard and floppy disk drive ports, and a built-in infrared link for point-to-point wireless communications. The Fujitsu can use either Pen Windows, PenPoint, or PenDOS.

By contrast, Big Blue's offering, the IBM ThinkPad 710T, is by far a better product than the ThinkPad 700T released last November but still needs improvement. The ThinkPad 710T is powered by IBM's 486SLC/25 CPU, which gives this portable more punch to drive PenPoint or CIC's PenDOS. Still on the large side, the ThinkPad 710T is slightly smaller and lighter than the ThinkPad 700T, measuring 11.7 by 9.6 by 1.4 inches and weighing 5.2 pounds with its battery. It comes in two configurations: with three PCMCIA Type II sockets for storage, modems, and I/O, and a version with an internal 60MB hard disk and one PCMCIA socket. It has an AT bus connector for a planned docking station. The target is vertical markets where form-filling applications are prevalent, such as the insurance and health care industries. The ThinkPad 710T is presently available on special bid from IBM.

▶ FACT FILE
DecisionPoint
Fujitsu Personal Systems Inc., 5200 Patrick Henry Dr., Santa Clara, CA 95054; 408-982-9500; fax, 408-496-0609.
List price: *$2,295.*

▶ FACT FILE
IBM ThinkPad 710T
IBM Personal Computer Corp., Rte. 100, Somers, NY 10589; 800-772-2227.
List price: *Currently by special bid.*

NEW CPUs

The NEC UltraLite Autograph is one of the most powerful computers in this group. Using Intel's 3.3-volt 486SL/20, the NEC comes with either PenPoint ($4,099) or Pen Windows ($3,999). Equipped with 4MB of RAM and expandable to 12MB, the NEC comes with an internal 40MB 1.8-inch hard disk; an optional 80MB unit will be available.

The NEC weighs 3.9 pounds with its nickel hydride battery and measures 10.9 by 9.8 by 1.2 inches. It comes with two PCMCIA Type II sockets, and enhanced parallel, serial, PS/2 keyboard/mouse, external floppy drive, and simultaneous external VGA ports. NEC is the first to implement the Peripheral Interface (PI) bus in the 486SL processor to speed video response, one of pen computing's shortcomings.

These systems open up new ways to use computers. Their work will revolve around pen-centric applications such as insurance paperwork, surveys, sales reports, and other form-based programs.

The NEC uses a CalComp digitizer and untethered pen and has a 9.4-inch-diagonal VGA screen. Programmable icons along the edge of the panel can trigger common tasks or programs.

The $3,499 Toshiba T100X Dynapad is one of the first computers to be powered by AMD's 3.3-volt 386SXLV/25. Weighing 3.3 pounds, it comes with 4MB of RAM (expandable to 20MB), a 40MB hard disk, and two PCMCIA Type II sockets. Its 9.5-inch-diagonal transreflective (non-backlit) VGA LCD screen uses most of the 10.4- by 7.1- by 1.4-inch case, which is very easy to hold. Display contrast and brightness controls are located on the screen and are adjusted with a tap of the pen tip.

The Toshiba has standard serial and PS/2 keyboard ports, and proprietary parallel and floppy disk drive ports. The nickel hydride battery pack is among the smallest and lightest we've seen—about the size of a pack of cigarettes—and Toshiba claims a worst-case battery life of 2.5 hours during constant use. Like the NEC, it uses a CalComp digitizer with an active pen that fits into a holder built in the case.

The company sells the Toshiba through pen-oriented VARs, which means you probably won't find it in Toshiba's usual outlets. It comes installed with either Pen Windows or PenPoint.

▶ FACT FILE
Dynapad
Toshiba America Information Systems Inc., 9740 Irvine Blvd., Irvine, CA 92718; 800-334-3445, 714-583-3000.
List price: *$3,499.*

▶ FACT FILE
UltraLite Autograph
NEC Technologies, 1414 Massachusetts Ave., Boxborough, MA 01719; 800-388-8888, 508-264-8000; fax, 800-366-0476.
List price: *Pen Windows, $3,999; PenPoint, $4,099.*

LIMITATIONS TO POWER

Although the features and configurations may remind you of a top-notch notebook, except for the Dauphin these are not meant to be notebook replacements. They are systems that open up new ways to use computers, and whose worth will revolve around their first use with single-purpose pen-centric applications such as filling out insurance paperwork, surveys, physician information sheets, sales reports, and other form-based programs. The perceptions and limitations of what pen computing is all about are finally falling back to earth, and we believe these are the best pen computers yet.—*Christopher Barr*

Compudyne™ Notebooks. More Of What

Compudyne is the PC manufacturing and direct marketing arm of Comp USA™, The Computer SuperStore (NYSE symbol: CPU)—inventors of big volume, deep discounting PC retailing, and the largest chain of computer super stores in the country. Compudyne manufactures top quality, fully-supported computers as available from only the largest PC manufacturers, at prices typically found only at garage shop clone houses.

Result? We're already one of the largest direct PC companies in the country and guarantee that our prices are the lowest of any currently advertised.

INTERNAL OPTIONS: (USER INSTALLABLE)

- Math Co-Processor
- Memory Upgrades: 2 or 4 MB on 386, 4 or 16 MB on 486
- 2400 bps Data Modems with: 4800 bps send-only FAX, or MNP-5 & 9600 bps send/receive FAX

EXTERNAL OPTIONS:

- External 5.25" Floppy Drive
- External Numeric Keypad
- Expansion Station
- Auto Adapter
- Standard or Leather Carrying Bag
- Spare NiCad Battery

You Want. Less Of What You Don't.

SUPPORT & WARRANTIES:

- 30-day no-questions-asked return policy**
- Toll-free telephone technical support
- 1 year limited warranty on parts and labor
- Overnight replacement if needed

"With a Graphics Winmark score of 2.3 million, the Compudyne 486DX/33 gives you desktop performance and storage in 7.6 pounds of travel weight." (8/92)

"...You'll be hard-pressed to find a unit with a better blend of speed, portability, and quality construction than the SlimNote." (8/92)

"The Compudyne SlimNote 4DX/33... (uses) a marvelous design that wraps a 33 MHz 486DX in a package just over 6 lbs. (This was one) of our favorites." (12/92)

"For the quietest slimmest notebook, get the Compudyne 486DX/33." BYTE (9/92)

"...Inexpensive, highly portable, good battery life, big screen, great keyboard with built-in trackball." PC WORLD (9/92)

"It (486DX/33) does everything the fastest desk-top systems will do, and requires almost no concession on your part. It's a great system, and an even better buy." Laptop Issue (9/92)

TO ORDER CALL: 1-800-862-3099

In Canada: 1-214-702-0055
24 hr fax: 1-214-888-5743

All new prices!

NOTEBOOK	CPU	RAM (MBS)	BATT. LIFE (HRS)	HD (MBS)	PRICE
386SXL/25	386SXL-25 MHz. OPTIONAL 80387SX	2	3.5+	80	$1,399 $52/mo*
386SL/25	INTEL 80386SL-25 MHz. 64K CPU CACHE ADVANCED SL POWER MGM'T.	2	3.5+	80	$1,499 $56/mo*
486SX/33	INTEL 80486SX-33 MHz. 8K CPU CACHE	4	2.5+	80	$1,999 $74/mo*
486DX/33	INTEL 80486DX-33 MHz. 8K CPU CACHE	4	2.5+	130	$2,499 $93/mo*

Ask About Our Corporate Credit & Volume Terms!

Business Hours (CDT): Mon.-Fri. 7am-10pm; Sat. 9am-5pm

COMPUDYNE

THE LOWEST OF THE LOW PRICES. GUARANTEED.

PCM0334

Magazine quotes courtesy of: PC Computing December 1992 pg 78. ©1992 Ziff Communications Company. BYTE Magazine September1992. PC Sources, reprinted from PC SOURCES August 1992. ©1992 Coastal Associates Publishing L.P. PC Magazine reprinted from PC Magazine August 1992, ©1992 Ziff Communications Company. PC World, September 1992 pg 108. *Leasing through Leasing Group Inc. payments based on 36 month open-end rate. **Must be returned as new in original packaging. Prices and specifications subject to change without notice. - - Trademarks belong to their registered owners. On-site service not available for notebooks. Compudyne Direct, 15167 Business Ave, Dallas, TX 75244.

CIRCLE 132 ON READER SERVICE CARD

available without the use of an Fn key. Both have easily removable 120MB hard disks that make it simple to share a machine—as well as to install upgrades and maintain system security. The biggest surprise, the ThinkPoint II, is a unique pointing stick that protrudes from between the G and H keys. When put to use with the two click buttons located beneath and in front of the space bar, the stick controls cursor speed and movement by detecting the pressure used to push it. The control stick comes in red (which makes it easy to find) and also in black, and its unobtrusive placement between the touch typist's home keys works well.

▶ IBM ThinkPad 700C

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	FAIR
Windows applications	GOOD
Desktop replacement	GOOD
VENDOR SERVICE & RELIABILITY	
Overall Reliability	AVERAGE
Repair Satisfaction	AVERAGE
Tech Support satisfaction	ABOVE AVERAGE

The ThinkPad 700 has an IBM 486SLC/25 CPU. Its 64-gray-scale edgelit passive-matrix monochrome LCD is as good as this class of screen gets, with little bleeding between differently shaded areas. On both models, the screen folds back flat for use with an external monitor.

A single charge from the small AC adapter powered the ThinkPad 700 for an average of 3 hours and 32 minutes on our Battery Rundown test and 4 hours and 12 minutes on our ZDigit Rundown test, with power saving enabled. On other benchmark tests, the ThinkPad 700 held its own; it scored among the top ten in Microsoft Windows graphics performance, but the rest of its scores were not exceptional.

Based on an IBM 486SLC/25 CPU, the high-end ThinkPad 700C has everything but a low price. It has a large, beautiful, active-matrix color screen and good battery life for its class. Its screen, capable of 256 colors in 640-by-480 VGA mode, is 10.5 inches diagonally—the largest active-matrix color screen sold on a notebook to date. Its colors are crisp and clear. Video performance is excellent as well: The ThinkPad 700C had the fastest DOS video score and the second-fastest Graphics Winmark score.

Although the color screen runs fast and looks great, it adds to the system's thickness and power consumption. At 2.5 inches, the ThinkPad 700C is more than half an inch thicker than the ThinkPad 700. The color notebook's battery life was 1 hour and 46 minutes on our Battery Rundown test but a strong 3 hours and 30 minutes on the ZDigit Rundown test, with power conservation enabled.

Both ThinkPad 700 models earn the highest recommendation. If you have the money, it's hard to walk away from the 700C; those on tighter budgets will still enjoy the 700's design features.—*BB*

▶ FACT FILE

IBM ThinkPad 700

IBM ThinkPad 700C

IBM Personal Computer Co., Rte. 100, Somers, NY 10589; 800-772-2227; fax, 800-426-4329

List price (tested configuration): ThinkPad 700, $2,950; ThinkPad 700C, $4,825.

Tested configuration: 4MB 70-ns RAM (ThinkPad 700), 8MB 80-ns RAM (ThinkPad 700C); 120MB IBM 54G0133 IDE hard disk, 1.44MB floppy disk drive, DOS 5.0, Prodigy 3.2.

Options: 4MB RAM upgrade, $475; 8MB RAM upgrade, $945; processor upgrade kit, $595; mouse, $75; expansion chassis, $895; extra battery, $175; 2,400-/9,600-bps data/fax modem, $365; numeric keypad, $80; quick charger, $195; replacement AC power adapter, $95; 12-volt battery adapter, $165; network expansion chassis, $445; OS/2 2.0, $195; carrying case, $80; color upgrade kit, $2,495.

In short: A removable hard disk, integrated pointing device, and a fine monochrome screen make the IBM ThinkPad 700 an excellent machine. If you can afford it, the IBM ThinkPad 700C is one of the best notebooks on the market. Its top features include a superior active-matrix color screen and a usable mouse substitute.

462 ON READER SERVICE CARD

Northgate

ZXPortable Active Color
ZXPortable 486DX/25

Northgate's two powerful 486-based notebooks cover both ends of the portable computing spectrum: for $2,349, the ZXPortable 486DX/25 delivers a fast, inexpensive passive-matrix monochrome unit; for $3,799, the ZXPortable Active Color gives you excellent active-matrix color. Both systems come standard with Intel's 486SX/25 processor, but you can upgrade either one of these machines to a 486DX/25 for an additional $350.

Both models are housed in an attractive, well-built case, with one serial and one parallel port, an expansion slot, an internal modem slot, and external VGA and keyboard connectors. Northgate offers three docking stations with different combinations of features. The least expensive ($599) contains three full-length ISA expansion slots, a 1.2MB floppy disk drive, and an extra 5.25-inch drive bay.

Northgate ▶ ZXPortable Active Color

SUITABILITY TO TASK	
Road warrior comm.	FAIR
DOS applications	GOOD
Windows applications	GOOD
Desktop replacement	GOOD

We tested the ZXPortable with the 486DX/25 upgrade. Sharp's 10-inch passive-matrix monochrome screen has 64 shades of gray but suffers from several faults common to passive-matrix screens, including muddiness, spotting, and the disappearing cursor. On our benchmark tests, the unit performed very well. Except for on the DOS video and Graphics Winmark test suites, the monochrome unit turned in scores that ranked among the top ten on our benchmark test suite.

Northgate ▶ ZXPortable 486DX/25

SUITABILITY TO TASK	
Road warrior comm	GOOD
DOS applications	GOOD
Windows applications	GOOD
Desktop replacement	GOOD

We tested the ZXPortable Active

FACT FILE

Northgate ZXPortable Active Color

List price: $3,799

Tested configuration: 486SX/25, 4MB 70-ns RAM, 121MB Conner CP-2124 IDE hard disk with 64K buffer, 1.44MB floppy disk drive, 2,400-bps data/fax modem, DOS 5.0, Microsoft Windows 3.1, mouse, carrying case

Options: With 486DX/25 processor, $350; 4MB RAM upgrade, $250; 12MB RAM upgrade, $720. Docking stations, $599 to $1,299. Extra battery, $119; 2,400-/9,600-bps data/fax modem, $229; replacement AC power adapter, $99

In short: The ZXPortable Active Color combines the virtues of an excellent screen and top-flight performance

Northgate ZXPortable 486DX/25

List price: $2,349

Tested configuration: 486DX/25 processor; same components as for color unit

Options: With 486SX/25 processor, $1,999; same options as for color unit

In short: The ZXPortable offers low-cost 486-based power with a passive-matrix monochrome screen

Northgate, 7075 Flying Cloud Dr., Eden Prarie, MN 55434; 800-548-1993, 612-943-8181; fax, 612-643-6965

483 ON READER SERVICE CARD

Color with its standard 486SX/25 processor. The unit's most distinguishing feature is its 8.5-inch active-matrix TFT color display, also from Sharp. Its 0.27-mm dot-pitch screen displays 256 colors simultaneously at 640-by-480 resolution. A 60:1 contrast ratio ensures a wide viewing angle and eliminates all ghost images while running under Windows. The fast refresh rate of the active-matrix screen eliminates cursor disappearance, a problem in passive-matrix color notebooks when you move the mouse quickly.

Besides being easy to view, the ZXPortable Active Color performed admirably even without the 486DX upgrade, turning in scores well above average on our entire suite of benchmark tests. Most notably, it produced an excellent Graphics Winmark score that ranked third in our test group.

The nickel hydride batteries in both notebooks produced respectable times for 486-based units. On our Battery Rundown test, the ZXPortable Active Color averaged 1 hour 55 minutes; the ZXPortable, 2 hours 40 minutes. On our ZDigit Rundown test, with power conservation enabled, the color unit averaged 2 hours 48 minutes; the monochrome, 3 hours 16 minutes.

In an effort to retain a full-size keyboard, Northgate made the inverted-T cursor keys, the Ins and Del keys, and the dedicated PgUp, PgDn, Home, and End keys smaller than the letter keys; the design feels cramped.

Northgate offers a standard warranty and a deluxe warranty ($99) that lets you get a replacement notebook and gives you the option of keeping it or having the old one repaired.—*Tim Albano*

Poly NB433DX

SUITABILITY TO TASK	
Road warrior comm.	FAIR
DOS applications	GOOD
Windows applications	GOOD
Desktop replacement	GOOD

Polywell Computers Inc.

Poly NB433DX

The $2,240 Poly NB433DX contains a powerful CPU and components to match, but misses the mark in terms of screen clarity, weight, and overall design.

The prime engine for the Poly's generally strong scores on our performance tests is Intel's 486DX/33 CPU. Although the Poly's DOS processor scores trailed those recorded by the Intel 486DX2/50-based machines, the Poly was still among the top twenty percent of PCs reviewed on our CPU benchmark. It also rated in the top twenty percent in the DOS memory and Disk Winmark test suites.

Its DOS memory score was aided by its ACC cache controller, although we were surprised by how much the 32K cache improved the test results. The Cirrus Logic video chip set with 256K of video memory posted a below-average DOS video score but a top-ten Graphics Winmark score. The Toshiba 130MB hard disk has a fast 16-ns access time and contains 32K of memory, but provided only an average DOS disk mark.

While the components pack a punch, the design of the notebook doesn't. The unit weighs 7.1 pounds and the AC adapter adds another 1.7 pounds, which puts the package at close to 9 pounds. The passive-matrix display is tough to read from an angle and produces small shadows. Moreover, the trackball is awkwardly placed on the unit's front edge. While pushing the left trackball button, you could hit the nearby standby button and inadvertently send the unit into sleep mode. Polywell claims the CPU

FACT FILE

Poly NB433DX

Polywell Computers Inc., 61-C Airport Blvd., San Francisco, CA 94080; 800-999-1278, 415-583-7222; fax, 415-583-1974

List price: $2,240

Tested configuration: 4MB 80-ns RAM with 32K external RAM cache, 130MB Toshiba MK-2124FC IDE hard disk, 9,600-/2,400-bps data/fax modem, 1.44MB floppy disk drive, DOS 5.0, Microsoft Windows 3.1, trackball, carrying case

Options: With 486DX2/66 processor, $2,640; 200MB hard disk, $400; 8MB RAM upgrade, $340; 16MB RAM upgrade, $680; 128K RAM cache upgrade, $80; docking station, $550; extra battery, $95; 9,600-/2,400-bps fax modem, $155; Ethernet network adapter, $230; external floppy disk drive, $550; external keyboard, $50; numeric keypad, $110; battery charger, $95; 12-volt battery adapter, $100

In short: The Poly NB433DX's powerful processor is overshadowed by a poor design and a heavy case

484

The

DTK Computer Inc.

Los Angeles (818) 810-0098	**Houston** (713) 568-6688	**Miami** (305) 597-8888
Chicago (708) 593-3080	**New Jersey** (908) 562-8800	

Gràfika™ Machine... VERY Graphic Intensive.

Unleashing the power and intensity of today's most spectacular graphics, the Gràfika family of computers from DTK brings your visual designs to life at warp speed.

Combining high performance and a wide range of capabilities, the Gràfika family offers flexibility unsurpassed in comparable computers. That means we've got a system tailor-made for almost any applications—from quality graphics and DTP, to highly technical CAE/CAD/CAM, and the most advanced multimedia animation.

Plus, the entire Gràfika family features quality Intel microprocessors for both power and reliability. All of our computers are backed by one year of free on-site service and toll-free technical support.

With over 12 years in the market place, DTK offers a combination of experience and stability that can provide you with exactly what you need—so you only pay for what you want. It's that kind of customer satisfaction that has made us the #1 rated supplier among resellers in the industry.

So call 1-800-GRAFIKA today for more information or the name of the Gràfika dealer nearest you. And find out how DTK can meet your graphic-intensive requirements.

intel inside

Novell Labs Tested & Approved

OTHER OFFICES LOCATED IN:

- Paris
- Tokyo
- Taipei
- Vienna
- Düsseldorf
- Munich
- Madrid
- Hong Kong
- Washington

DTK logo and Bare Bone are registered trademarks of DTK Computer, Inc. All other brand names are registered trademarks of their respective companies. Product specifications and configurations are subject to change without notice.

CIRCLE 143 ON READER SERVICE CARD

Double-Duty Duo

Apple Computer has sold more than half a million PowerBook notebooks in the past year; 25 percent of them were bought by people who use DOS and Microsoft Windows desktop machines. Why? The PowerBooks don't run any of their favorite applications, and they generally cost more than comparably powered notebooks in this survey.

The Duo Dock docking station turns laptop into desktop.

We discovered the reason for this seeming incongruity, after testing an Apple PowerBook Duo 230. Alone, the Duo 230 is a stylish, 4.2-pound notebook, but with its unique Duo Dock docking station, it becomes a powerful desktop system. The Duo 230 is more than 2 pounds lighter than other PowerBooks, mainly because it doesn't have an internal floppy disk drive and also uses a lightweight magnesium subframe. The unit we tested, however, suffered from occasional blackouts—which we came to regard as fainting spells—resulting from a pinched cable.

The Duo comes in two flavors. The Duo 210, which we tested, has a 25-MHz Motorola 68030 microprocessor. The Duo 230 has the 33-MHz version of the CPU. The Duo 230 is the same size but has an option for a 120MB hard disk. Both models have unremarkable monochrome screens, slightly stiff keyboards, and require vampire-fanged adapters to connect to common peripherals on the road.

On the other hand, some would argue that Macintosh system software is what Windows wants to be when it grows up. The PowerBook's trackball, which is located dead center on the case's front, is one of the best implementations we have seen.

When it's souped up with an optional collection of hardware and software called the DOS Companion ($219), the Duos can swap data easily between Macintosh and DOS-Windows versions of the same application, such as Microsoft Excel or Microsoft Word. It can also use "DOS" peripherals such as HP LaserJet printers and VGA monitors.

The real beauty of the Duo line emerges when it disappears into the Duo Dock and is transformed into a versatile desktop system. Apple's Duo Dock has taken the docking concept a step forward by literally grabbing the subnotebook from you: The docking bay is motorized and pulls the Duo, guiding it into place. The 152-pin connector on the back of the Duo is guided gently but precisely to its port and held there, preventing accidental disconnection. An eject button on the Duo Dock lets you release the Duo, freeing the portable so you can take it with you.

An added bonus: The Duo Dock automatically charges the Duo's battery. A particularly nice feature is its ability to "remember" its network and big-screen connections. When the Duo is returned to its Duo Dock, it doesn't have to be manually reconfigured, making set-up quick and easy.—*Peter Lewis*

is upgradable to the next-generation Intel chip. But with a Battery Rundown time of 1 hour 28 minutes, the power-hungry Pentium might make this the shortest-lived notebook available.—*AC*

Sharp Electronics Corp.

Sharp PC-6881
Sharp PC-7750

Features that Sharp Electronics Corp.'s two new notebook systems have in common include good screens and reasonable list prices, but short battery lives. The monochrome passive-matrix PC-7750 has a 486DX/33-based CPU and lists for $3,199, although this price does not include the modem and trackball. The active-matrix color PC-6881, with a 386SL/25 CPU in our tested configuration, costs $3,698.

Sharp PC-6881

SUITABILITY TO TASK	
Road warrior comm.	FAIR
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	FAIR
VENDOR SERVICE & RELIABILITY	
Overall Reliability	AVERAGE
Repair Satisfaction	BELOW AVERAGE
Tech Support satisfaction	AVERAGE

Even though both of our test units came with trackballs already built-in, only the PC-6881 has one as a standard feature. In each case, the two trackball buttons are on the top left, just above the keyboard. Oddly, the PC-6881's trackball is way over on the right side, while the ball for the PC-7750 is on the left near the buttons. The trackballs do not have much resistance but are still better than carrying a mouse.

Sharp PC-7750

SUITABILITY TO TASK	
Road warrior comm.	FAIR
DOS applications	GOOD
Windows applications	GOOD
Desktop replacement	GOOD
VENDOR SERVICE & RELIABILITY	
Overall Reliability	AVERAGE
Repair Satisfaction	BELOW AVERAGE
Tech Support satisfaction	AVERAGE

The screen in the PC-6881 is a fine, crisp active-matrix color performer. The unit has a $3,698 price tag, which is reasonable for any notebook with a screen of this cali-

Photograph by John Greenleigh, courtesy of Apple Computer Inc.

ber, although it has a 25-MHz 386SL instead of a 486-based processor. The screen is viewable from all angles, but since it folds back only 155 degrees, you can't fold the PC-6881 flat and slide it under an external monitor.

Competing against 486s, the relatively slow 386SL CPU held the PC-6881 to low scores on most of our benchmark tests, including battery life. Its 49-minute rundown time, though short, was within the manufacturer's 40- to 60-minute rated specification. Sharp sells an additional battery pack that clips onto the back of the unit for greater battery life. The PC-6881's time on the ZDigit Rundown test, with power saving enabled, was 1 hour 10 minutes.

The PC-6881 is thus not the machine to take on cross-country plane trips without extra batteries. This system works best as an easy-to-carry desktop replacement if you want a color screen but don't demand the fastest performance.

If you want a fast portable computer but aren't too demanding about battery life, the $3,607 monochrome passive matrix PC-7750 is a good bet. Its 33-MHz 486DX CPU helped it achieve high scores on many of our benchmark tests, even without an external RAM cache.

While you can't usually read passive-matrix LCD screens well from side angles, the PC-7750's screen is crisper and shows fewer shadows than most others in its class. The unit averaged 1 hour 55 minutes on the Battery Rundown test and 2 hours 34 minutes on the ZDigit Rundown test. The PC-7750's sole power-management feature is a setting that turns off the LCD backlight and the hard disk after a user-adjustable interval.

The PC-7750 delivers fair performance with a good passive-matrix monochrome screen. The built-in trackball is another convenient option. If low battery life isn't a problem, the PC-7750 is a good choice as a midlevel notebook.—*BB*

FACT FILE

Sharp PC-6881

List price: $3,698

Tested configuration: 4MB 80-ns RAM with 16K external cache, 80MB IBM WDA280 IDE hard disk with 8K buffer, 1.44MB floppy disk drive, DOS 5.0, external battery.

Options: 2MB RAM upgrade, $299; 4MB RAM upgrade, $549; docking station, $999, 2,400-bps modem, $329; numeric keypad, $119; extra battery, $119.

In short: The Sharp PC-6881 offers a fine active-matrix color screen, but suffers from short battery life

Sharp PC-7750

List price: $3,607

Tested configuration: 4MB 70-ns RAM, 124MB Toshiba MK2124FC IDE hard disk with 32K buffer, 1.44MB floppy disk drive, 9,600-/2,400-bps data/fax modem, DOS 5.0, Microsoft Windows 3.1, internal trackball

Options: 4MB RAM upgrade, $419; extra battery, $119, 2,400-/9,600-bps data/fax modem, $299,

In short: The unit offers a good monochrome passive-matrix screen, but has below-average battery life.

Sharp Electronics Corp., Sharp Plaza, Mahwah, NJ 07430; 800-732-8221, 201-529-9593; fax, 201-529-9637

485 ON READER SERVICE CARD

Swan Technologies Inc.

Swan 486/SLC-25 Notebook

For $2,393, Swan Technologies offers a decent notebook that gets the job done. It's a Cx486SLC/25-based unit with a nice price, but its performance doesn't stand out.

The Swan 486/SLC-25 Notebook has all the basics: 4MB of RAM (8MB maximum), a 117MB hard disk, and a fax modem. But the Swan's expansion and full networking capabilities come up short. It has no docking station, PCMCIA slot, or high-speed I/O ports, and offers no hard disk that is larger than 117MB.

Swan 486/SLC-25 Notebook

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	FAIR

On the plus side, those who make presentations will like the simultaneous-display capabilities and a screen that can lie flat. Since the screen is passive-matrix, however, viewing it at an angle is difficult. The keyboard has ten function keys that are a bit less than half-size. There is an embedded keypad for use with the Fn key, but no separate PgUp, PgDn, Home, or End keys. The cursor keys, laid out in an inverted T, can serve as a mouse emulator, with the Alt and Ctrl keys acting like mouse buttons.

Performance was in the middle of the pack, with the processor, memory, and both video scores falling a tad below the mean. The removable Quantum Go Drive produced the unit's best scores: It ranked 8th under DOS and came in solidly average under Microsoft Windows. The drive gave us some trou-

FACT FILE

Swan 486/SLC-25 Notebook

Swan Technologies Inc., 3075 Research Dr., State College, PA 16801; 800-468-9044, 814-234-2236; fax, 814-237-4450

List price (tested configuration): $2,393

Tested configuration: 4MB 70-ns RAM, 117MB Quantum Go Drive 120AT IDE hard disk, 2,400-bps data modem, 1.44MB floppy disk drive, DOS 5.0, Microsoft Window 3.1, carrying case.

Options: 6MB RAM upgrade, $370; 8MB RAM upgrade, $550, extra battery, $99, $129, 9,600-/2,400-bps fax modem, $249; numeric keypad, $49, quick charger, $89, replacement AC power adapter, $59

In short: The Swan 486/SLC-25 notebook offers quite a bit for the money, including a 117MB Quantum Go Drive hard disk, a passive-matrix LCD panel, and a modem. Its removable hard disk performed well on PC Magazine Labs' benchmark tests, and this portable placed just slightly below the average on our other benchmark tests

486 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES CONTINUES

Portable PCs

List price (tested configuration) Not all portable computers are available in comparable configurations. For this reason, we report the price of each system as tested and reviewed at PC Magazine Labs.

Dealers/Direct distribution channel Various machines are sold directly through mail order, through dealers, or, increasingly, through company-owned stores and superstores.

System weight/travel weight Each notebook's system weight includes the weight of the battery. The travel weight adds that of the AC adapter brick and power cord.

Keys: total, function, cursor The table describes each color portable's built-in keyboard: the **total** number of keys, the number of **function** keys, and the number of **cursor** keys. If you have only four cursor keys and you need to access PgUp, PgDn, Home, or End, you must hold a function key and tap one of the arrow keys—an inconvenient procedure.

Type of pointing device installed Many notebooks ship with a bundled or integrated pointing device, which falls into one of four categories: *free-standing* (a normal serial or PS/2-style mouse), *built-in* (for instance, a trackball that has been built into the system's case), *clip-on* (a separate portable pointing device that clips onto the system's case and runs via an external serial adapter cable), and *snap-on* (similar to a clip-on, but using a special port and requiring no serial cable).

The **BIOS version (or date)** can affect the system's performance on our benchmark tests. A machine with another BIOS may perform differently.

PCMCIA slots accept removable I/O devices roughly the size of a credit card. Currently, add-in components that fit this form factor include expansion memory, nonvolatile static RAM for storage, and modems. The PCMCIA (Personal Computer Memory Card International Association) standard continues to evolve; there are currently three versions: Type I, Type II, and Type III.

Internal modem installed indicates the type of modem bundled with the vendor's computer. Other modems, including PCMCIA devices, may be available. The maximum data and fax communication speeds are listed; all fax modems have send and receive capabilities unless noted.

Ports for port replicator/expansion chassis Some machines have expansion ports that let the system bus connect to two types of optional external devices: a *port replicator* (which re-creates the I/O ports and can easily be removed from the system without disconnecting all your peripherals) or an *expansion chassis* (an external floppy disk drive or full-fledged docking station with additional ports and space for expansion cards).

Screen manufacturer Most vendors purchase liquid crystal displays from outside sources. These panels are physically limited in the number of gray shades or colors they can display.

The chip set and video memory determine the **maximum external resolution** and the number of simultaneous colors the external monitor can display at that resolution. Decreasing the resolution setting usually increases the **maximum external colors.**

Illuminated screen/Active matrix An illuminated screen is either backlit, edgelit, or sidelit. **Active-matrix** displays are brighter, provide richer colors or shades of gray, and are easier to view at an angle than passive-matrix screens are.

The **AC adapter size** can vary significantly among machines with similar power needs.

The table includes the **rated battery life** for each system as reported by the vendor. PC Magazine Labs independently tests the battery life and reports the results in the benchmark test section. We also indicate the battery **charge time** with the unit on and off, as reported by the vendors.

The **battery weight, amp/hour rating** shows the battery's weight in pounds, as well as how many hours that battery is rated to deliver a steady current of one ampere. You'll find wide discrepancies among the sizes and power ratings of batteries that go in the units reviewed in this issue.

The battery-powered systems in this review all include power-conservation features, such as automatic **display** dimming or blanking, automatic **hard disk power-down** (a common feature), slowing or halting the **CPU,** and **peripherals power-down** for removing power to the I/O ports (modem and serial ports) when the machine is not in use. More advanced power-management features include **standby** mode (in which a system preserves its current state in memory, usually via a secondary battery) and **hibernation** (in which the system's state is written to the hard disk). The latter ensures that the system never loses its information when battery power fails.

Warranty All systems included in this roundup came with a one-year parts-and-labor warranty or better. See the individual reviews for details on each vendor's support policies.

Each system has an **FCC Class B identification number,** which means it has sufficiently low radio-frequency emissions to be used in the home. To verify any system's status, you may dial up the Public Access Link, the Federal Communications Commission's own bulletin board service, at 301-725-1072.

ble after removal and reinsertion, but was otherwise problem-free.

The 7.55-pound Swan (with battery and AC adapter) lasted just under 2 hours on our Battery Rundown test, and 2 hours 48 minutes on the ZDigit Rundown test with power conservation enabled. Swan offers a one-year warranty, a 30-day money-back guarantee, an excellent manual, and toll-free technical support.—*Anush Yegyazarian*

Tenex Computer Express

Tenex Notebook 386DXL/33

Even though many vendors try to strike exclusive deals with original equipment manufacturers (OEMs), often several vendors still wind up selling the same machine. When we reviewed notebooks for our December 22, 1992, issue, Micro Express sent us its NP933. This time, Tenex Computer Express has what amounts to the same notebook, which it has called the Tenex Notebook 386DXL/33 and priced at $1,538. The Micro Express rendition was at best average, and Tenex has done nothing to improve upon it.

You'll probably notice the two batteries first: They snap in just below the monochrome display. Though these yielded competitive battery times at 3 hours 11

There Is Strength In Numbers.

intel inside

TravelMate™ 4000 WinSX™ or WinDX™
- 486 SX/25MHz or 486 DX/25MHz
- 4MB RAM std. (20MB max.)
- 120MB HDD
- 5.6 pounds

$2,799/$3,299 SRP*

TravelMate 4000 WinDX2™
- 486 DX2/50MHz
- 8MB RAM std. (20MB max.)
- 200MB HDD
- 5.6 pounds

$3,899 SRP*

TravelMate 4000 WinSX COLOR
- 486 SX/25MHz
- 4MB RAM std. (20MB max.)
- 120MB HDD
- 6.3 pounds

$3,699 SRP*

TravelMate 4000 WinDX2 COLOR
- 486 DX2/40MHz
- 8MB RAM std. (20MB max.)
- 200MB HDD
- 6.3 pounds

$4,499 SRP*

Texas Instruments comes on strong with the widest selection of powerful 486 notebooks at incredible prices. From 25MHz to the world's most powerful 50MHz notebook in a 5.6-pound package, there's a TI TravelMate just for you.

Take a look at these numbers. You get superior 486 performance with an extraordinary three to five hours of battery life. On our color models, you get 256 simultaneous brilliant colors on a large 9.4" display. All these numbers add up to outstanding performance and value.

There's one more important number. For more information and the dealer nearest you, call 1-800-527-3500.

MICROSOFT WINDOWS READY TO RUN

TEXAS INSTRUMENTS

CHOICE PAK PC EXPERT

PORTABLE COMPUTING PRODUCT EXCELLENCE

MOBILE OFFICE

PC Computing MVP 92 FINALIST

TravelMate, WinSX, WinDX and WinDX2 are trademarks of Texas Instruments. The Ready-to-Run logo is a trademark of Microsoft Corporation. The Intel Inside logo is a trademark of Intel Corporation.

*Manufacturer's Suggested Retail Price. Dealer prices may vary.

© 1993 TI

CIRCLE 353 ON READER SERVICE CARD

SUMMARY OF FEATURES

Portable PCs

Products listed in alphabetical order

■ = YES □ = NO

	Aspen Personal 486	AST PowerExec 3/25SL	BCC Avanti 486/V32 Model 200	BSI NB486DX2-50	CAF AquaLITE-II	Compaq Contura 3/25C
List price (*PC Magazine* configuration)	$1,595	$2,795	$3,295	$2,150	$1,299	$2,499
Processor type and speed	Cyrix Cx486SLC/25	Intel 386SL/25	Cyrix Cx486SLC/25	Intel 486DX2/50	AMD Am386SXL/25	Intel 386SL/25
Hard disk capacity	60MB	120MB	200MB	202MB	80MB	85MB
Dealers/Direct-distribution channel	■□	■□	■□	■■	■■	■■
Dimensions (HWD, in inches)	2.3 x 11.5 x 8.5	2 x 11.5 x 8.3	2 x 11 x 8.5	2 x 10.8 x 10	1.5 x 11 x 8.5	2 x 11.5 x 8.8
System weight/travel weight (pounds)	7.2, 8.8	6.2, 7.5	6.6, 7.9	8.5, 10	5.4, 6.7	6.9, 8
Display area and diagonal (inches)	5.8 x 7.8, 9.8	5.8 x 7.8, 9.8	5.8 x 7.8, 9.8	5 x 7, 8.5	5.8 x 7.8, 9.8	5.4 x 7.3, 8.9
Keys: total, function, cursor	82, 12, 8	82, 12, 8	80, 12, 4	82, 10, 8	84, 10, 8	80, 10, 8
Type of pointing device installed	None	Snap-on	Free-standing	None	None	None
Motherboard						
Motherboard manufacturer	Aspen	AST	BCC	BSI	CAF	Compaq
Chip set manufacturer	Headland	Intel	WD	ETEQ	VLSI	Intel
BIOS version (or date)	AMI 1.0	AST (7/13/92)	Award 4.24	Award (11/22/89)	Phoenix 1.01	Compaq (9/4/92)
Setup in ROM/Password in ROM	■■	■■	■■	■□	■■	■■
System shadowing/Video shadowing	□□	■■	■■	■■	□□	■□
Memory and Disk Drives						
Installable RAM	1MB–5MB	4MB–20MB	4MB–8MB	2MB–16MB	2MB–8MB	4MB–12MB
User-installable	■	■	■	□	■	□
External processor RAM cache	None	64K	None	None	None	64K
Available hard disk sizes	60MB–124MB	60MB–200MB	120MB–200MB	80MB–240MB	80MB–120MB	84MB–120MB
I/O and Expansion						
Parallel, serial, mouse, expansion ports	1, 1, 0, 1	1, 1, 1, 1	1, 1, 1, 0	1, 2, 1, 1	1, 2, 1, 0	1, 1, 1, 0
High-speed parallel/serial support	□□	■□	□■	□■	■□	■■
Ports for port replicator/expansion chassis	□□	■■	□□	□■	□□	■□
PCMCIA slots	None	Two Type II	None	None	None	None
Internal modem installed	2,400-/9,600-bps fax	None	2,400-/9,600-bps send-only fax	None	None	None
Video						
Screen/Video chip set manufacturer	Sharp/Cirrus	Toshiba, Sanyo / WD	Sharp/WD	Hitachi/Cirrus	Sharp/VLSI	Sharp/Compaq
Simultaneous external display	□	■	□	□	■	■
Maximum internal resolution	640 x 480	640 x 480	640 x 480	640 x 480	640 x 480	640 x 480
Maximum internal gray shades/colors	64, N/A*	64, N/A*	32, N/A*	32, N/A*	64, N/A*	N/A*, 16
Maximum external resolution	800 x 600	1,024 x 768	640 x 480	800 x 600	800 x 600	800 x 600
Maximum external colors	256	16	16	16	16	16
Illuminated screen/Active matrix	■□	■□	■□	■□	■□	■□
AC Adapter and Battery						
AC adapter size (inches)	2 x 3 x 6.5	2.8 x 4.5 x 1.5	2.3 x 3 x 6.3	2.3 x 3 x 6.3	1.5 x 5.3 x 2.5	1.4 x 5.3 x 3.4
Rated battery life (hours)	2.5	4	2.5	2.5	2.5	3
ZDigit Rundown, Battery Rundown (hr:min)	2:34, 1:25	3:58, 3:27	2:49, 2:16	2:06, 1:42	3:44, 2:17	3:44, 1:57
Charge time while on, off (hours)	5, 2	1.5, 1	10, 1	2, 2	2, 2	1.5, 1
Battery weight, amp/hour rating	1.2 lbs, 4.3Ah	1.5 lbs, 2.2Ah	1.2 lbs, 1.7Ah	2.2 lbs, 2.8Ah	1.1 lbs, 1.7Ah	1.3 lbs, 2.2Ah
Display/hard disk power-down	■■	■■	■■	■■	■■	■■
CPU/peripherals power-down	□□	■□	■■	□□	□□	■■
Standby/Hibernation	■□	■■	■□	■□	■■	■■
Miscellaneous						
DOS 5.0, Microsoft Windows 3.1	■■	■□	■■	□□	■□	■■
Warranty	1 year	1 year	1 year	1 year	1 year	3 years
First year on-site service charge	N/A*	N/A*	N/A*	N/A*	N/A*	Included
FCC Class B identification number	GNT2530-758	DJKPWRE386-25SL	I7N48625	FMA3530	ARFNEL36X25	CNT75MBZ4B

N/A*—Not applicable: The product does not have this feature. N/A**—Not applicable: The product could not perform this test

BSI—Broadax Systems Inc., C&T—Chips & Technologies Inc., DIT—Display Technologies Inc., NTC—Nan Tan Computer Co., VLSI—VLSI Technology Inc., WD—Western Digital

CONTINUES

Compaq LTE Lite 4/25C	Compaq LTE Lite/25E	CompuAdd 425C	Ergo Modular Color 486SLC NoteBrick	Ergo Modular 486SLC NoteBrick
$4,099	$2,999	$2,595	$3,993	$2,493
Intel 486SL/25	Intel 386SL/25	Cyrix Cx486SLC/25	Cyrix Cx486SLC/25	Cyrix Cx486SLC/25
120MB	84MB	85MB	120MB	120MB
□■	■■	■■	□■	□■
2 x 11 x 8.5	2 x 11 x 8.5	1.8 x 11 x 8.5	2 x 11.6 x 8.6	1.8 x 11.6 x 8.6
6.6, 7.8	6.5, 7.3	5.9, 7.1	6.5, 7.9	6.2, 7.5
5.1 x 6.4, 8.4	5.7 x 7.6, 9.5	5.3 x 6.8, 8.5	5.2 x 6.8, 8.5	5.7 x 7.6, 9.4
80, 10, 8	80, 10, 8	81, 12, 8	85, 12, 8	85, 12, 8
Built-in	Built-in	Built-in	Snap-on	Snap-on
Compaq	Compaq	Compal	Veridata	Veridata
Compaq	Compaq	VLSI	Headland	Headland
Compaq (9/4/92)	Compaq (9/23/92)	Phoenix (4/9/90)	Award 3.20	Award 3.20
■■	■■	■■	■□	■□
■■	■■	■■	■■	■■
4MB–20MB	4MB–20MB	4MB–8MB	4MB–8MB	4MB–8MB
■	■	□	■	■
None	64K	None	None	None
120MB–210MB	84MB–120MB	85MB–122MB	120MB–180MB	120MB–180MB
1, 1, 1, 1	1, 1, 1, 1	1, 2, 0, 0	1, 1, 0, 1	1, 2, 0, 0
■■	■■	□□	□□	■■
□■	□■	□□	□□	□□
One Type I, one Type II	None	None	None	None
None	None	None	2,400-/9,600-bps fax	2,400-/9,600-bps fax
Compaq/Compaq	Compaq/Compaq	Sanyo/Cirrus	Sharp/Cirrus	Sanyo/Cirrus
■	■	■	■	■
640 x 480	640 x 480	640 x 480	640 x 480	640 x 480
N/A*, 16	32, N/A*	N/A*, 16	N/A*, 16	32, N/A*
800 x 600	800 x 600	800 x 600	800 x 600	800 x 600
16	256	16	16	16
■■	■■	■□	■■	■□
1.4 x 5.3 x 3.3	1.4 x 5.3 x 3.3	1.5 x 2.7 x 5.5	1.8 x 5.8 x 5.9	1.8 x 5.8 x 5.9
2.5	4	2	1.5	2.5
4:12, 2:06	4:12, 2:59	N/A**, 2:11	2:20, 1:33	2:48, 2:07
2, 1	2, 1	4, 4	3, 2	3, 2
1.3 lbs, 2.2Ah	1.3 lbs, 2.2Ah	1.3 lbs, 1.7Ah	1.1 lbs, 2.4Ah	1.1 lbs, 2.5Ah
■■	■■	■■	■■	■■
■■	■■	■■	■■	■■
■■	■■	■□	■□	■□
■■	■■	■■	■□	■□
3 years	3 years	1 year on parts, 2 years on labor	1 year	1 year
Included	Included	$90	N/A*	N/A*
CNT75MAFAE	CNT75MAFAD	IIRTS34XC-25	HLOXP691C25T	HLOXP691C

FACT FILE

Tenex Notebook 386DXL/33

Tenex Computer Express, 56800 Magnetic Dr., Mishawaka, IN 46545; 800-776-6781, 219-259-7051; fax, 219-259-0300

List price: $1,538.

Tested configuration: 4MB 80-ns RAM with 32K external RAM cache, 85MB Toshiba MK-2024 IDE hard disk with 32K buffer, DOS 5.0, Microsoft Windows 3.1.

Options: 210MB hard disk, $349.99; 2MB RAM upgrade, $129.99; 4MB RAM upgrade, $229.99; mouse, $16.99-$19.99; trackball, $34.99; PortaPoint, $74.99; extra battery, $69.99; 9,600-/2,400-bps fax modem, $179.99; Ethernet network adapter, $249.99; ARCnet network adapter, $159.99; external floppy disk drive and second serial port adapter, $279; external keyboard, $279; quick charger, $99.99; 12-volt battery adapter, $29.99; SCSI interface, $99.99.

In short: The Tenex Computer Express version of a machine also offered by Micro Express offers nothing new but managed an average showing.

467 ON READER SERVICE CARD

Tenex Notebook 386DXL/33

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	FAIR

minutes on the Battery Rundown test, and 4 hours 12 minutes on the ZDigit Rundown test, they add weight to an already slightly oversized system. The system's keyboard has decently-sized keys, inverted-T cursor keys, and separate Home, End, PgUp, and PgDn keys. Key travel seemed too long, however, resulting in a wobbly feel. While there is no provision for an internal modem, either slot provided for the two batteries can be used for fax modems or other attachments. Upgrading memory requires removing the system's rubber feet, opening

Portable PCs

SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

	Ergo Nifty Fifty 486/50 Color NoteBrick	Expo Note 33	GRiD 1660C	Hyundai Courier Spectra	IBM ThinkPad 300
List price (*PC Magazine* configuration)	$4,145	$1,237	$4,795	$2,999	$2,480
Processor type and speed	Intel 486DX2/50	AMD Am386SX/SL-33	Intel 386SL/25	Cyrix Cx486SLC/25	Intel 386SL/25
Hard disk capacity	120MB	60MB	125MB	120MB	80MB
Dealers/Direct-distribution channel	■ ■	■ ■	□ ■	■ ■	■ ■
Dimensions (HWD, in inches)	1.9 x 11.2 x 8.1	2 x 11.3 x 9.2	2.2 x 11.8 x 8.6	2.3 x 11 x 8.8	2 x 12 x 8.5
System weight/travel weight (pounds)	6.6, 8	6.5, 8	6.8, 7.9	5.7, 5.9	5.9, 7.7
Display area and diagonal (inches)	5.3 x 6.8, 8.5	5.2 x 6.9, 8.5	5.2 x 6.8, 8.5	5 x 6.8, 8.5	5.8 x 7.6, 9.5
Keys: total, function, cursor	84, 10, 8	80, 12, 4	82, 12, 8	87, 12, 8	82, 12, 8
Type of pointing device installed	Free-standing	None	Built-in	Built-in	Free-standing
Motherboard					
Motherboard manufacturer	NTC	VTech	GRiD	Lexmark	Info not available
Chip set manufacturer	ETEQ	VTech	Intel	WD	Info not available
BIOS version (or date)	Award 3.20	AMI (9/12/92)	Phoenix 1.10.01	Phoenix 1.01	Info not available
Setup in ROM/Password in ROM	■ □	■ ■	□ ■	■ □	■ ■
System shadowing/Video shadowing	■ ■	■ ■	■ ■	■ ■	□ ■
Memory and Disk Drives					
Installable RAM	4MB–16MB	2MB–6MB	4MB–8MB	4MB–16MB	2MB–12MB
User-installable	■	■	■	□	■
External processor RAM cache	None	None	64K	None	64K
Available hard disk sizes	120MB–260MB	60MB	125MB	120MB	80MB–120MB
I/O and Expansion					
Parallel, serial, mouse, expansion ports	1, 2, 0, 1	1, 2, 1, 0	1, 1, 1, 1	1, 1, 1, 0	1, 1, 1, 0
High-speed parallel/serial support	□ □	□ □	□ □	□ □	■ □
Ports for port replicator/expansion chassis	□ □	□ □	□ ■	□ □	■ □
PCMCIA slots	None	None	None	None	None
Internal modem installed	None	None	2,400-/9,600-bps fax	2,400-/4,800-bps send-only fax	None
Video					
Screen/Video chip set manufacturer	Sanyo/C&T	Seiko/Cirrus	Sharp/Cirrus	Sanyo/WD	Sanyo/Intel
Simultaneous external display	■	■	■	□	■
Maximum internal resolution	640 x 480	640 x 480	640 x 480	640 x 480	640 x 480
Maximum internal gray shades/colors	N/A*, 256	64, N/A*	N/A*, 16	N/A*, 16	64, N/A*
Maximum external resolution	800 x 600	800 x 600	800 x 600	800 x 600	800 x 600
Maximum external colors	256	16	16	16	16
Illuminated screen/Active matrix	■ □	■ □	■ ■	■ □	■ □
AC Adapter and Battery					
AC adapter size (inches)	2.5 x 6.5 x 3	1.9 x 5.5 x 2.8	1.5 x 5.5 x 2.5	1.8 x 5.8 x 3	1.4 x 2.8 x 5.9
Rated battery life (hours)	1	4.5	2	2	4
ZDigit Rundown, Battery Rundown (hr:min)	2:08, 1:39	3:16, 2:46	2.48, 1.24	2.35, 1.11	5.09, 4.18
Charge time while on, off (hours)	2, 1.5	4, 1	3, 1.5	3, 1.5	3, 3
Battery weight, amp/hour rating	1.3 lbs, 1.4Ah	1 lb, 1.7Ah	1 lb, 1.5Ah	0.7 lbs, 1.4Ah	1.2 lbs, 2.2Ah
Display/hard disk power-down	■ ■	■ ■	■ ■	■ ■	■ ■
CPU/peripherals power-down	□ □	■ ■	■ ■	■ ■	■ ■
Standby/Hibernation	■ □	■ □	■ □	■ □	■ ■
Miscellaneous					
DOS 5.0, Microsoft Windows 3.1	■ □	■ □	■ ■	■ ■	□ □
Warranty	1 year	1 year	1 year	18 months	1 year
First year on-site service charge	N/A*	N/A*	$325	Included	$40
FCC Class B identification number	FMA5500C	IFS 80-2551	ACJ9TG25-3576	IYL1366728	IFO-386SL25

N/A*—Not applicable. The product does not have this feature. N/A**—Not applicable. The product could not perform this test.
BSI—Broadax Systems Inc., C&T—Chips & Technologies Inc., DiT—Display Technologies Inc., NTC—Nan Tan Computer Co., VLSI—VLSI Technology Inc., WD—Western Digital

CONTINUES

IBM ThinkPad 700	IBM ThinkPad 700C	Northgate ZXPortable Active Color	Northgate ZXPortable 486DX/25	PC Brand 486/SLC Color LeaderBook
$2,950	$4,825	$3,799	$2,349	$2,495
IBM 486SLC/25	IBM 486SLC/25	Intel 486SX/25	Intel 486DX/25	Cyrix Cx486SLC/25
120MB	120MB	121MB	121MB	80MB
■■	■■	■■	■■	□■
1.9 x 11.6 x 8.3	2.5 x 11.5 x 8.3	2 x 11 x 8.5	2 x 11 x 8.3	1.9 x 11 x 8.5
6.5, 7.9	7.6, 9.1	6.2, 7.9	5.9, 7.6	5.9, 7.2
5.8 x 7.6, 9.5	6.5 x 8.5, 10.4	5.3 x 6.9, 8.8	5.9 x 7.8, 9.8	6.5 x 8.5, 10 8
84, 12, 8	84, 12, 8	86, 12, 8	85, 12, 8	82, 12, 4
Built-in	Built-in	Snap-on	Snap-on	Built-in
IBM	IBM	Northgate	Northgate	PC Brand
IBM	IBM	OPTi	OPTi	VLSI
IBM (9/3/92)	IBM (9/3/92)	Phoenix 1.01	Phoenix 1.01	Phoenix 1.01
□■	□■	■■	■■	■■
□■	□■	□□	□□	■■
4MB–16MB	4MB–16MB	4MB–16MB	4MB–16MB	2MB–8MB
■	■	■	■	□
None	None	None	None	None
80MB–120MB	120MB	120MB	120MB	80MB–120MB
1, 1, 1, 1	1, 1, 1, 1	1, 1, 1, 1	1, 1, 1, 1	1, 1, 0, 1
■□	■□	□□	□□	□□
□■	□■	□■	□■	□■
None	None	None	None	None
None	None	None	None	None
DTI/IBM	DTI/IBM	Sharp/C&T	Sharp/C&T	Sharp/Cirrus
■	■	■	■	■
640 x 480	640 x 480	640 x 480	640 x 480	640 x 480
64, N/A*	N/A*, 4,096	N/A*, 256	64, N/A*	N/A*, 16
640 x 480	640 x 480	1,024 x 768	800 x 600	640 x 480
256	256	16	16	256
■□	■■	■■	■■	■□
1.6 x 2.8 x 5.5	1.6 x 2.8 x 5.5	2 x 3 x 7.1	2 x 3 x 7.1	1.5 x 3.9 x 5.4
7.5	3	2.5	4.5	2.5
4:12, 3:32	3:30, 1:46	2:49, 1:55	3:16, 2:40	N/A**, 1:53
3, 2	1 5, 1 5	1.5, 1	1.40, 1.10	4, 4.5
1.4 lbs, 2.9Ah	1.4 lbs, 2.9Ah	1 lb, 2.2Ah	1 lb, 2.2Ah	1.3 lbs, 1.5Ah
■■	■■	■■	■■	■■
■■	■■	■□	■■	■■
■□	■□	■□	■□	■□
■□	■□	■■	■■	■■
3 years	3 years	1 year	1 year	1 year
$40	$40	N/A*	N/A*	N/A*
ANO9552M	ANO9552C	BEJG48SIN25L	BEJG48SIN25L	IIRTS34XC-25

the case, and removing the keyboard.

Performance was fair considering that the Tenex was competing against a number of 486-class machines. The unit received midrange processor and memory scores, but suprisingly good video results, considering that it uses only 256K of video memory. Disk scores under both DOS and Microsoft Windows fell to somewhat below average. Tenex offers a one-year parts-and-labor warranty.—*OR*

Texas Instruments Inc.

TI TravelMate 4000 WinDX2/50
Ti TravelMate WinSLC

With powerful components as well as travel weights of less than seven pounds, the latest offerings from Texas Instruments—the TI TravelMate 4000 WinDX2/50 and the TI TravelMate WinSLC—are winners.

TI TravelMate 4000 WinDX2/50

SUITABILITY TO TASK	
Road warrior comm	GOOD
DOS applications	EXCELLENT
Windows applications	GOOD
Desktop replacement	EXCELLENT
VENDOR SERVICE & RELIABILITY	
Overall Reliability	AVERAGE
Repair Satisfaction	AVERAGE
Tech Support satisfaction	AVERAGE

Both TravelMates have monochrome passive-matrix screens made by Sharp. The WinDX2/50 ($3,899) displays 64 shades of gray and handles 256 colors externally; it has full-screen text support. The WinSLC ($2,278) also has 64 gray shades, but only 16 colors externally. It has a slower screen refresh rate, and the image tends to look washed out at the corners and streaked with shadows.

TI TravelMate WinSLC

SUITABILITY TO TASK	
Road warrior comm	GOOD
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	FAIR
VENDOR SERVICE & RELIABILITY	
Overall Reliability	AVERAGE
Repair Satisfaction	AVERAGE
Tech Support satisfaction	AVERAGE

To bring these systems to below 7 pounds, TI used lightweight plastics that give a flexible feel, but

Now we're your source

1990, 1991 and 1992 World Class Awards
for Best Mail-Order Company

☐ 3½" format available. Specify when ordering.
⊞ package includes both 5¼" and 3½" disks.
⊠ 3½" format available from manufacturer by request. Call us for details.
All software is not copy-protected, unless indicated otherwise by *(CP)*.

The four-digit number next to each product is the product's ITEM NUMBER. Please refer to this number when ordering. Thank you.

We carry only the latest versions of products. Version numbers are current at press time. Products listed here in red are Microsoft Windows Applications.

COMPETITIVE UPGRADES

Please call for criteria to qualify to trade up for these popular products. Policies may vary depending on vendor.

Alpha Software
9724 ☐Alpha FOUR 2.1 Competitive Upgrade ..... $89.
Approach Software
3830 ⊞Approach for Windows Competitive Upgrade .. 95
Borland International
3684 ☐Quattro Pro 1.0 Windows Competitive Upgrd. 89.
Claris Corp.
5228 ⊞FileMaker Pro Competitive Upgrade . .. . 89.
Corel Systems
4560 ☐CorelDRAW! 3.0 Competitive Upgrade ..... 179.
Gold Disk
5412 ☐Gold Disk Professional Draw Comp. Upgrd. . 115.
Microsoft
5693 ☐Excel 4.0 Competitive Upgrade ..... 125.
8353 ☐PowerPoint 3 0 Competitive Upgrade .... 125.
3881 ☐Word for Windows 2.0A Competitive Upgrade 125.

SOFTWARE

AddStor
8807 ⊞SuperStor Pro 1.0 ..... 85.
Adobe Systems
7547 ⊞Adobe Type Manager 2.5 for Windows ..... 59.
6591 ☐Adobe Illustrator 4.0 for Windows ..... 388.
7940 ☐Adobe Type Set Value Pack *(30 fonts)* 39
(Entire Adobe Type Library available.)
AGFA
10396 ⊞Discovery TrueType Pack ..... 49.
Aldus
1332 ☐PageMaker 5.0 for Windows ..... 589.
Alpha Software
5104 ⊞Alpha FOUR 2.0 *(incl. Free 2 LAN Pack)*..... 329.
Altsys Corporation
8675 Fontographer for Windows *(3½" only)*..... 259.
Application Techniques
8337 ⊞WinDings 1.0 for Windows ..... 49.
1214 ⊞Pizazz Plus 3.0 ..... 79.
Approach Software
6598 ⊞Approach 2.0 for Windows ..... 259.
Ares Software
6030 ⊞FontMonger 1.06 for Windows ..... 89.
Artisoft
2455 Lantastic AE-2 EtherNet Starter Kit 4.1..... 469.
9775 Lantastic AE-2 Starter Kit for Windows ..... 499.
2452 AE-2 EtherNet Adapter Card..... 199.
Atech Software
4797 ⊞AllType 2.0 *(universal typeface converter)*..... 45.
10078 ⊞Variety Font Pack 1.0 ..... 49.
Automap
2729 ⊞Automap USA for DOS.. 55. 8569 Windows . 55.
Avery Dennison
6006 ⊞Label Pro 1.6 *(Laser)*..... 49.
Banner Blue Software
2088 ⊞Org Plus 1 0 for Windows . ... 125.
Berkeley Systems
9885 ⊞After Dark 2.0 for Windows .... 29.
6649 Star Trek: The Screen Saver *(3½" only)*..... 34.

NEW!

Compaq Computer ... 3 years
9549 *ProLinea 4/25s w/240 MB*—We are now an authorized Compaq reseller. You get a 25 MHz 486SX processor, 4 MB of RAM expandable to 32 MB, a 240 MB hard drive, three ISA expansion slots, & a mouse. Plus brilliant high-resolution video (256 flicker-free colors at 1024 x 768) & MS-DOS 5.0 & Windows 3.1 pre-installed. Compaq quality backed by our World Class Award-winning customer support! *(monitor not included)* **$1399.**

Other Models available.
9548 *ProLinea 3/25s with 84 MB*..... **939.**
9553 *LTE Lite/25c with 120 MB*..... **3589.**
9550 *Contura 3/25c with 84 MB* ..... **2349.**
9551 *Contura 3/25c with 120 MB* ..... **2629.**

Bitstream
8040 ⊞FaceLift 2.0 for WordPerfect 5.0/5.1 ..... 69.
2089 ⊞MakeUp 1.1 for Windows 3.0/3.1 ..... 79.
Borland International
9635 ☐Object Vision 2.1 ..... 99.
10616 Quattro Pro for Windows *(3½" only)*..... 95.
1514 ☐Paradox 4.0 ..... 529.
Broderbund
5900 ⊞PC USA 2.0..... 29. 5902 ⊞PC Globe 5.0.... 39.
8855 ☐Print Shop Deluxe 1.0 ..... 45.
Caere
4130 ⊞Faxmaster 1.0 ..... 95.
8933 ⊞Omnipage Professional 2 1 ..... 629.
Central Point
8114 ⊞Backup 7.1.... 89. 5039 ☐PC Tools 8.0.... 125.
ChipSoft
1663 ⊞Turbo Tax Personal 1040 for DOS..... 49.
3517 ⊞Turbo Tax Personal 1040 for Windows..... 49.
6221 ⊞Turbo Tax/Quicken Bundle 10.1/6.0 Final..... 59.
3080 ⊞Turbo Tax Windows/Quicken Bundle 10.1/2.0 59.
⊞Turbo Tax State Packages for DOS..... ea. 39.
5366 ⊞Turbo Tax DOS/Tax Tutor + 1992..... 79.
Claris Corp.
5257 ⊞FileMaker Pro 2.0 for Windows 268
CompuServe
7546 ⊞DOS Membership Kit 2.0..... 25.
Concentric Data Systems
6575 ⊞R& R Report Writer DOS 159. 9236 Windows 159.
Contact Software
1625 ⊞Act! 2.1 ..... 239.
Corel Systems
5506 ☐CorelDRAW! 3.0... 395
Data Storm
4798 ⊞PROCOMM PLUS 2.01.. 69. 6918 Windows . 99.
DCA/Crosstalk
5611 ⊞Crosstalk 2.0 for Windows..... 119.
Delrina Technology
2446 ⊞WinFaxPro 3.0.. 79. 5974 ⊞DOSFax PRO.. 49.
10454 ⊞Windows Communications PAK..... 145.
DeltaPoint
5172 ⊞FreezeFrame 1.0 for Windows 62
8750 ☐DeltaGraph Professional 1.0 for Windows .... 339.
ExperVision
7494 ⊞TypeReader 2.0 Windows ..... 499.
Fifth Generation Systems
7725 ⊞Direct Access 5.1 ..... 64.
3950 ⊞Fastback Plus.... 119. 6431 ⊞ Windows 119
Fractal Design
7822 ⊞Sketcher 1.0 for Windows ..... 94.
Gibson Research
9832 ⊞SpinRite II 2.0..... 59.
Hewlett-Packard
8731 ⊞Dashboard 1.0 for Windows ..... 45.
IBM
7303 ☐OS/2 2.0 Upgrade from DOS ..... 99.
Inset Systems
7296 ⊞HiJaak 2.1.... 139. 3820 ⊞for Windows ... 135.
Intuit
2426 ⊞Quicken 5.0.... 45. 5596 ⊞for Windows..... 45.
LaserTools
6882 ⊞PrintCache 3.1..... 49.
9510 ⊞PrimeType 1.0 for WordPerfect..... 62.
Lotus
5417 ☐1-2-3 3.4..... 399.
5653 ☐1-2-3 2.4..... 335. 1852 ☐Upgrade ..... 99.
2755 ☐1-2-3 1.1 for Windows. 309. 3424 ☐Upgrd. 99.

5799 ⊞Ami Pro 3 0 239 1847 Competitive Upgrade 99.
3523 ☐Freelance 2 0 Windows 349. 4983 ☐Upgrd. 99.
5981 ☐SmartSuite..... 469.
1493 ⊞Organizer for Windows..... 99.
MECA
2798 ⊞Managing Your Money 9.0 ..... 32.
4603 ⊞TaxCut 1992..... 37.
3885 ⊞TaxCut 1992 for Windows . . . . . 37.
⊞State Tax Packages ..... ea. 32.
Microcom
6234 ⊞CarbonCopy Plus 6.1.. 129. 6958 Upgrade 45.
4410 ⊞CarbonCopy Plus 1.0 for Windows ..... 129.
Micrografx
3627 ☐Windows Draw! 3.0 ..... 99.
MicroLogic Software
5350 ⊞TrueType 1.0 for DOS..... 49.
8579 ⊞MoreFonts 3.0..... 75.
Microsoft
8355 ☐Access 1 0 for Windows..... call
7834 Cinemania *(CD-ROM)*..... 55.
7010 ☐Windows 3.1. ..... 89.
6224 ☐Windows for Workgroups Upgrade ..... 89.
6141 ☐Windows for Workgroups Add-on. ..... 59.
2904 ☐Works 3.0..... 95. 2735 ⊞ 2 0 Windows .. 129
3337 ⊞Publisher 1 0 for Windows ..... 129.
7387 ☐PowerPoint 3.0 for Windows ..... 299.
6195 ⊞Word 2 0 for Windows . . . . . 299.
2856 ☐Excel 4.0 for Windows..... 299.
7388 ⊞Project 3.0 for Windows . . . . . 445.
8137 ☐Office 3.0 for Windows . . . . . 449.
1620 ☐MS-DOS 5 Upgrade ..... 59.
10058 ☐FoxPro 2.5 DOS.. 299. 10056 Windows .. 299.
10051 ⊞Font Pack 2 for Windows..... 45.
1624 ⊞Visual Basic 2.0 Windows Standard Edition .. 129.
MicroSpeed
8659 ⊞Cursor Deluxe 1.0 ..... 27.
Nolo Press
2982 ⊞WillMaker 4.0..... 35.

$25 REBATE

Concentric Data Systems
⊞*R&R Report Writer, Xbase Ed.*—Create custom database reports without programming! Select, analyze, summarize, & present data in unlimited formats. Royalty-free runtime included. 6575 *DOS*. **$159.** 9236 Windows. **$159.**

for computers, too!

Norton-Lambert
2753 ☐Close-Up Dual Pack for Windows & DOS.... $129

Panacea
2413 ⊞WinSpeed 1.0 *(Windows accelerator)*..... 55.

PC-Kwik
4924 ☐Super PC-Kwik 5.01..... 49.
4925 ☐PC-Kwik Power Pak 3.0 w/Power Disk..... 79.

Peachtree
5757 ⊞Accounting 5.0 for Windows..... 79

Personics
9288 Laptop Ultravision 2.1 *(3½" only)*..... 59.
7048 ⊞Monarch 2.0..... 319.

Polaris Software
4395 ⊞PackRat 4.1..... 249.

Qualitas
7539 ⊞386MAX 6.02..... 59.

Quarterdeck
3221 ☐Expanded Memory Manager 386 6.0..... 59.
4586 ☐DESQview 386 2.4..... 129.

Reality Technologies
6572 ⊞WealthBuilder 3.0 *(incl. Smart Investor)*..... 95.

Reference Software
4396 ⊞Grammatik V.... 55. 7483 ⊞for Windows... 55.

Shapeware
5426 Visio 1.0 for Windows *(3½" only)*..... 199.

Sitka
5450 ⊞10NET Starter Pack 5.0.1 *(two nodes)*..... 129.

Softnet
5883 FaxWorks 2.5 *(Windows & DOS) (3½" only)*..... 45.

Software Marketing Corporation
5147 ⊞Orbits 1.0..... 36. 5145 ⊞Bodyworks 1.0 ... 45.

Software Publishing
3482 ☐Harvard Graphics 399. 4403 ☐for Windows 369.

Stac Electronics
1409 ⊞Stacker 3.0..... 95.

Symantec
3784 ☐The Norton Backup 2.0 for Windows..... 99.
3146 ☐The Norton Utilities 6.01..... 115.
2359 ☐The Norton Desktop 2.0 for Windows..... 115.
8378 ☐Norton PC Anywhere 4.5..... 119.

TIMESLIPS
5698 ⊞Timeslips Release 5..... 189.

Touchstone Software
7420 ⊞Check It Plus 3.0..... 85.

Traveling Software
4407 ⊞LapLink Pro 4.0..... 99.

WordPerfect Corporation
3804 ☐WordPerfect... 269. 3494 ☐for Windows.... 279.

XTree
8328 ☐XTree 1.0 for Windows 65. 6161 ⊞Gold 2.5 95.

RECREATIONAL/EDUCATIONAL

Broderbund ... CP
3340 ⊞Kid Pix 1.0.. 35. 5851 ⊞SimCity from Maxis 29.
4411 ⊞SimEarth 1.0 for Windows from Maxis..... 45.

Interplay
8653 ⊞Mario Teaches Typing..... 24.
4692 ⊞Dvorak on Typing for Windows..... 29.

Inset Systems
3820 ⊡*HiJaak 1.0 for Windows*—Enhances & prints graphics images. Converts 23 raster, 15 vector, & 24 fax card formats. Captures graphics screens from Windows & graphics & text screens from DOS applications **$135.**

Microsoft
8492 ☐Golf for Windows..... $45.

Software Toolworks
4534 ⊞Mavis Beacon Teaches Typing 2.0 *(CP)*..... 29.
5032 Miracle Piano Teacher *(includes keyboard)*..... 325.

Walt Disney Computer Software
10100 ☐Aladdin Pnnt Kit 1.0..... 15.
9984 ⊞The Animation Studio 1.0..... 72.

HARDWARE

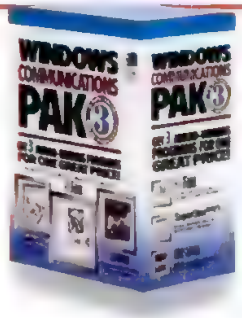
Warranties listed next to manufacturer.

3 Com ... lifetime (conditional)
3453 EtherLink II/16..... 159. 3469 II/16 TP..... 169.

American Power ... 2 years
7108 Smart UPS 400.... 339. 7105 Smart 600.... 439.
3819 Back-UPS 250..... 115. 3858 Back 400..... 179.
7107 Back-UPS 450..... 215. 3823 Back 600..... 295.

Appoint ... limited lifetime
2469 Thumbelina PC or 2480 MousePen Pro PC *ea.* 59.
9564 Gulliver..... 59.

ATI Technologies ... 5 years
8463 VGA Wonder XL24 *(with 1 MB)*..... 149.
3886 Graphics Ultra + *(with 2 MB)*..... 339.
3871 Graphics Ultra Pro *(with 2 MB)*..... 519.



Delrina Technology
10454 ⊡*Windows Communications PAK*—Solves all your communications needs. This value packed bundle includes the award-winning *WinFaxPro 3.0, Crosstalk for Windows,* and *SuperStor Pro*..... **$145.**

Boca Research ... 5 years
10468 SVGAX3 *(with Bit BCT acceleration)*..... 149.
7150 BOCARAM/AT PLUS *(2 MB)*..... 169.
7139 *(4 MB)*..... 239. 7138 *(8 MB)*..... 449.
6998 I/O Board for AT.. 49. 6999 for PS/2..... 89.
8380 BasicVGA..... 49. 8381 SuperVGA..... 115.

Caere ... 1 year
8158 Typist Plus Graphics..... 299.

Canon ... 1 year
We are an authorized Canon Service Center.
7893 BJ-10ex BubbleJet Printer *(4.6 lb.)*..... 255.
7809 BJ200 BubbleJet Printer..... 369.
8940 BJ-C800 Color BubbleJet Printer..... 1899.
7897 BubbleJet Ink Cartridge *(BJ-10ex)*..... 23.

Cardinal ... lifetime
8690 MVP24I Modem Value Pack..... 39.
7867 MVP96IF FaxModem Value Pack..... 195.

Compaq Computer ... 3 years
9548 ProLinea 3/25s with 84 MB, Windows *(monitor not included)*..... 919.
9549 ProLinea 4/25s with 240 MB, Windows *(monitor not included)*..... 1399.

800-800-0004

MEMBER DIRECT MARKETING ASSOCIATION

PC Connection
6 Mill Street
Marlow, NH 03456
SALES 603-446-0004 **FAX** 603-446-7791

MECA
Up to $30 in rebates direct from MECA (limited time—call for details).
2798 ⊡*Managing Your Money 9.0*..... **$32.**
4603 ⊡*TaxCut 1992*..... 37.
⊡*State Tax Packages*..... *ea.* 32.

9554 LTE Lite/25c with 84 MB..... 3289.
9553 LTE Lite/25c with 120 MB..... 3589.
9552 Contura 3/25 with 120 MB, Windows..... 2059.
9551 Contura 3/25c with 120 MB, Windows..... 2629.
9550 Contura 3/25c with 84 MB, Windows..... 2349.

CoStar ... 1 year
10300 Address Express..... 689.

COVOX ... 1 year
5543 Sound Master II..... 145.

Creative Labs ... 1 year
8578 Sound Blaster.. 99. 2336 Sound Blaster Pro 189.
5770 Sound Blaster 16..... 229.

Curtis ... lifetime
7358 Command Center SPF-4..... 79.

Cyrix Corporation ... 5 years
9877 FasMath 83S87-16 *(SX compatible)*..... 69.
9875 FasMath 83D87-25 or 9876 83D87-33..... *ea.* 89.

Diamond Computer ... 5 years
10079 Stealth 24 Graphics Accelerator..... 165.
8333 SpeedStar 24X Graphics Accelerator..... 165.

Epson ... 2 years
We are an authorized Epson Service Center
5555 AP-3250 *(80 col., 200 cps, 24 pin)*..... 199.
2358 LQ-570 *(80 col., 252 cps)*..... 259.
2361 LQ-870 *(80 col., 330 cps)*..... 489.
2357 LQ-1170 *(136 col., 330 cps)*..... 669.

Hauppauge Computer ... 1 year
4008 WinTV..... 439.

Hayes ... 2 years
9039 Accura 2400 *(ext.)*.... 85. 9033 *(internal)*..... 79.
7391 ULTRA 96 Modem.. 599. 5024 ULTRA 144 . 669.
1345 OPTIMA 24 Modem 125. 3522 OPTIMA 96 . 349.
8187 OPTIMA 24+FAX96..... 159.
7395 OPTIMA 144+FAX144..... 479.

Hewlett-Packard ... 1 year
7620 DeskJet 550C *(color) (with ink cartridge)*..... 789.
9993 LaserJet IIIP *(with toner)*..... 1099.
6442 LaserJet 4 *(with toner)*..... 1499.

Intel ... 3 years
3864 14.4EX Modem..... 469.
1086 Matched Memory Classic Memory Board ØK.... 95.
8479 Above Board ISA ØK..... 189.
10436 SatisFAXtion Modem 300..... 299.
5994 Modem 400..... 399. 5995 Modem 400E..... 449.
5999 ⊞FAXability Plus *(software)*..... 79.
6003 ⊞FAXability Plus OCR *(software)*..... 165.
2994 EtherExpress 16 or 3021 16 TP..... *ea.* 129.
MATH COPROCESSORS
4750 80387SX *(all 80386SX CPU's)*..... 79.
5409 80387DX *(all 80387DX CPU's)*..... 85.

Kensington Microware ... 1 year
Full line available. Partial listing.
2582 MasterPiece Plus..... 95. 2587 Remote..... 105.
7899 Expert Mouse *serial*... 99. 7900 *bus*..... 115.

Key Tronic ... 3 years
4518 101 Plus Keyboard..... 99.
4387 Trak 101 Keyboard *(with trackball)*..... 165.

KOSS Corporation ... lifetime
5459 HD-4 speakers with equalizer..... 49.

PC CONNECTION®

© COPYRIGHT PC CONNECTION, INC., 1993. PC CONNECTION, PCTV AND THE RACCOON CHARACTER(S) ARE REGISTERED TRADEMARKS OF PC CONNECTION, INC., MARLOW, NH. ALL OTHER TRADEMARKS REMAIN THE PROPERTY OF THEIR RESPECTIVE COMPANIES.

Compaqs sold here.

Logitech ... limited lifetime
3996 Trackman2 *(combo)* ... $84.
2343 Trackman Portable ... 59.
7975 ScanMan 256.. 289. 1015 ScanMan Color .. 599.
3295 Mouseman *(combo)*.... 69. 9766 *(cordless)* .... 89.
10573 Mouseman with TaxCut 1992 for Windows ... 99.

MediaVision ... 3 years
5637 ProAudio Spectrum 16 ... 199.
7873 Fusion CD 16 *(internal)* ... 519.
5638 MultiMedia PC Upgrade Kit 16 ... 969.

Megahertz ... 5 years
6576 External 9600 Pocket Fax/Modem ... 325.
7580 T3144 Internal 14.4 S/R Fax/Modem ... 529.
10514 P2144 14.4 Pocket Fax/Modem ... 499.
10515 C5144 14.4 Fax/Modem *(Compaq LTE/Contura)* 499.
10519 C5144 2400 /Modem *(Compaq LTE/Contura)* .... 119.

Microsoft ... lifetime
7597 Microsoft Mouse *(bus or serial)* ... 85.
2898 Mouse with Windows 3.0 *(bus or serial)* ... 149.
1896 Ballpoint Mouse *(serial only)* ... 119.

MicroSpeed ... 1 year
6007 PC-TRAC Trackball *serial* ... 75.

Microtek ... 1 year
5187 ScanMaker II 879. 5175 ScanMaker IIXE 1099.

Mouse Systems ... lifetime
3213 PC Trackball II *(serial)* ... 55.
7878 PC Mouse III *(serial)*.. 69. 5427 NewMouse .. 62.

Mustek ... 1 year
8454 Matador 105 for DOS ... 95.
7778 PrinScan105... 179. 7780 Color Artist Pro ... 399.
8455 6000C Color Scanner for Windows ... 999.

NEC ... 2 years
4252 MultiSync 3FGX Monitor *(14")* ... 689.
4249 4FG Monitor *(15")*.... 799. 3151 5FG *(17")*... 1449.

Okidata ... 1 year
We are an autorized Okidata Service Center.
5093 OL400 Page Printer *(4 ppm)* ... 649.
9590 OL810 Page... 1069. 5094 OL830 Page... 1299.
3025 Toner Cartridge ... 25.

Orchid Technologies ... 4 years
9417 Fahrenheit 1280 VA with 1 MB ... 229.
4071 Fahrenheit 1280i with 1 MB ... 229.

Pacific Data ... lifetime/60 day MBG
Memory upgrade for LJ IIP, III, IIID, IIIP:
7055 2 MB..... 119. 7759 4 MB ... 199.
7959 4 MB Upgrade for LaseJet 4 ... 165.
5729 ProTracer *(personal CAD printer) (1 yr.)*..... 1099.

PC Power & Cooling ... 2 years
9537 CPU Cooler *(for 386/33 up to 486)* ... 29.
3203 Turbo Cool 200 149. 7915 Turbo Cool 300 159.

Practical Peripherals ... lifetime
8993 PM2400 V.42bis *(int.)* 115. 8994 *(external)* 125.
8132 PM2400 Pocket Modem ... 109.
5437 PM2400F Pocket Modem ... 115.
5429 PM2400EFX SAV.42 bis *(external)* ... 145.
5428 PM2400EFX V.42 bis *(internal)* ... 139.
5436 PM2400F SA Mini *(external)* ... 79.
7934 PM9600SA Modem ... 289.
1344 PM2400FX96SA *(external modem/fax)* ... 99.
3803 PM14400FX *(internal modem/fax)* ... 359.
9234 PM14400FXPPM Fax/Modem ... 359.
2425 PM14400FXSA *(external modem/fax)* ... 399.

Targus ... lifetime
1305 Universal Notebook *(computer case)* ... 69.

Technology Concepts ... 2 years
6315 Fax Line Manager 203 ... 125.

TheComplete PC ... 2 years
6069 TheComplete Modem Plus ... $95.
8593 TheComplete Communicator Gold ... 389.

Tripp Lite ... 2 years
6199 Isobar 4-6 *(4 outlets, Gold Seal Warranty)* ... 49.
6200 Isobar 6-6 *(6 outlets, Gold Seal Warranty)* ... 59.
6797 OMNI 600 LAN Power Backup ... 369.
9312 BC500 Power Backup ... 219.

Video Seven ... 7 years
7362 WIN.VGA 1 MB *(1024 x 768,256 color)* ... 129.
9261 WIN.PRO 1 MB *(1024 x 768,256 color)* ... 175.

Zoom Telephonics ... 7 years
1166 AMX 2400 Baud External Modem ... 63.
1307 Int. 2400 Baud w/9600 Baud Fax Modem ... 79.
1178 Ext. 2400 Baud w/9600 Baud Fax Modem ... 92.
1494 Ext. 9600V.32..... 195. 3075 Internal ... 195.
3574 Ext. 2400 Baud V.42/9600 Baud Fax ... 115.
3386 FaxModem AFC *(2400 baud 96S/48R)* ... 59.
4430 FaxModem AFX *(2400 baud 96S/48R)* ... 79.
4429 FaxModem VFP V.32bis 14,400 baud *(internal)* 219.
4428 FaxModem VFX V.32bis 14,400 baud *(external)* 259.
7921 Pocket FaxModem ... 87.

DRIVES

Colorado Memory Systems ... 1 year
4194 Jumbo 120 Tape Backup ... 199.
4354 Jumbo 250 Tape Backup ... 269.
1213 Trakker 120 Tape Backup *(parallel)* ... 359.
1073 Trakker 250 Tape Backup *(parallel)* ... 429.

Conner Peripherals ... 1 year
2339 CP30104H 120 MB IDE HD *(19 ms)* ... 299.
1337 CP3204 200 MB IDE HD *(16 ms)* ... 429.

Logitech ... limited lifetime/MECA
3295 *Mouseman (combo)*—3 button ergonomic mouse ... $69.
3885 ◙ *TaxCut 1992 for Windows*—Guaranteed accurate tax preparation.... 37.
10573 *Mouseman with TaxCut Windows* 99.

IOMEGA ... 1 year
6499 Transportable 90 PRO ... 659.
10452 Transportable Multidisk 150 ... 849.
6343 PC Powered 90 *(incl. PC2B & cartridge)* ... 499.
6344 PC Powered 90 PRO *(incl. PC2B, cartridge & Central Point Software)* ... 599.
10537 PC Powered 150 ... 799.
10457 Dual Multidisk 150 ... 1699.
2500 PC2B-2 Controller ... 149.
2530 90 MB Cartridge..... 149. 2467 Tripak ..... 439.
8480 Tape250 Insider Tape Backup ... 239.
8481 Tape250 Inside Half-Height Tape Backup ... 259.
8482 Tape250 PC Powered Tape Backup ... 359.
10103 21 MB Floptical Drive *(internal)* ... 459.
10104 21 MB Floptical Drive *(PC Powered)* ... 499.

NEC ... 2 years
6582 CDR74 Portable CD-ROM Drive ... 629.
6581 CDR84 Internal CD-ROM *(reqs. interface)* ... 569.

Pacific Rim ... 1 year
1304 1.2 MB External *(for any parallel port)* ... 239.
2761 1.44EX MB Ext. *(for any parallel port)* ... 239.

Peripheral Land, Inc. ... 1 year
8735 Infinity Floptical Drive ... 399.
8736 Infinity 88 MB Removable *(Syquest)* ... 699.

Quantum ... 2 years
8287 Plus Hardcard II XL 105 MB *(9 ms)* ... 325.
4735 Hardcard E7 127 MB IDE *(17 ms)* ... 329.
4714 Hardcard E7 240 MB IDE *(16 ms)* ... 549.

TEAC ... 1 year
6951 1.2 MB Drive for AT ... 65.
4670 1.44 MB Drive for PC/XT *(3½")* ... 59.
4326 1.44 MB Drive for AT *(3½", with Bastech)* ... 75.
4414 3½"/5¼" Dual Floppy Drive ... 145.

Compaq Computer ... 3 years
9552 *Contura 3/25 with 120 MB*—25 MHz 386SL notebook weighing in at just over 6 lbs. This high powered system includes 4 MB RAM, 64K cache, built-in trackball, 120 MB IDE hard drive, & 640 x 480 display **$2059.**

MEMORY

6556 256k DRAMs *(100 nanosecond, set of 9)* ... call
5510 1 MB x 9 SIMMs *(80 nanosecond)* ... call
2497 4 MB x 9 SIMMs *(80 nanosecond)* ... call
5746 1 MB Chips *(80 ns, set of 9)* ... call

DISKS/MEDIA

Fuji ... lifetime
2214 3½" DS Disks*(10)*..... 9. 2242 *(50)*..... 32.
2215 3½" HD Disks*(10)*..... 15. 2241 *(50)*..... 59.
4863 3½" HD Disks *(20)* w/storage case ... 26.

Sony ... lifetime
3292 5¼" HD Disks*(Qty. 10)* ... 11.
3297 3½" DS Disks *(10)*..... 9. 6148 *(30)*..... 25.
3298 3½" HD Disks *(10)*.... 15. 6375 *(30)*..... 42.
8185 QD2040..... 14. 1895 QD2120..... 19.

3M ... lifetime
3943 DC2000..... 17. 1581 DC2120 ..... 22.

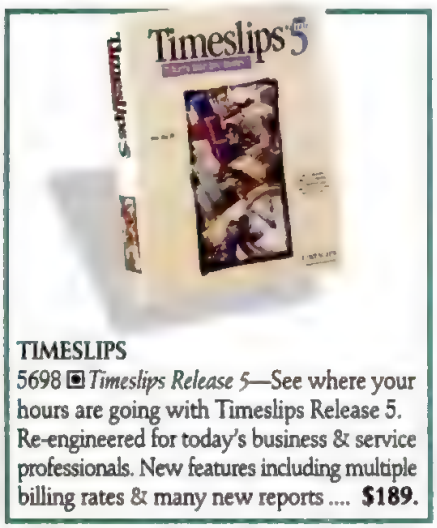
Toshiba ... lifetime
4858 3½" 2.88 MB ED Disks *(Qty. 5)* ... 17.
9755 3½" 2.88 MB ED Disks *(Qty. 10)* ... 29.

OUR POLICY

- We accept VISA and MASTERCARD.
- No surcharge added for credit card orders.
- Your card is not charged until we ship.
- If we must ship a partial order, we never charge freight on the shipment(s) that complete the order (in the U.S.).
- No sales tax, except Ohio residents (please add applicable tax).
- All U.S. shipments insured; no additional charge.
- APO/FPO orders shipped 1st Class Mail.
- International orders U.S. $100 minimum. Manufacturer support and upgrade eligibility may be limited outside the U.S.A.
- Upon receipt and approval, personal and company checks clear the same day for immediate shipment of your order.
- Corporate P.O.s accepted subject to approval.
- COD max. $1000. Cash or cashier's check. COD orders require an additional $4 charge. COD orders ship via UPS and may require additional UPS charges.
- 120 day limited warranty on all products. Defective software replaced immediately. Defective hardware repaired or replaced at our discretion. All items subject to availability. Prices and promotions subject to change without notice (e.g. SIMMs).
- Order lines opened continuously from 8 a.m. Monday until 5 p.m. Sunday ET. Business offices at 603-446-3383 Monday through Friday 9 a.m. to 5:30 p.m. ET.

SHIPPING

Continental U.S.: The total freight charge on any order placed with PC Connection is only $5. Barring events beyond our control, all credit card orders (no COD orders) phoned in weekdays by 3 a.m. ET will ship Airborne Express for delivery the next business day. Which means *same day* delivery for orders placed between midnight and 3 a.m. ET. (Some orders may ship by UPS Ground for next day delivery). Saturday delivery available to many areas upon request at no additional charge. Order all day Saturday through noon on Sunday for Monday delivery. (Some areas require an additional day delivery).
Hawaii, Alaska, Canada, Puerto Rico and the U.S. Virgin Islands: Shipping to these areas may require additional time and charges. Call 800-800-0004 for information.
All other areas: Please call 603-446-0004 or FAX 603-446-7791 for information.



TIMESLIPS
5698 ◙ *Timeslips Release 5*—See where your hours are going with Timeslips Release 5. Re-engineered for today's business & service professionals. New features including multiple billing rates & many new reports .... **$189.**

SINCE 1982

PC CONNECTION

YOUR SOURCE FOR PC SOFTWARE AND PERIPHERALS.

MARLOW, NEW HAMPSHIRE

W E H A V E

COMPAQ

3 YEAR WARRANTY

NO FOOLIN'!

FAST SHIPPING

AND WAIT 'TIL YOU SEE

THE PRICES!

©COPYRIGHT 1993 PC CONNECTION, INC. PC CONNECTION, EVERYTHING OVERNIGHT, AND THE RACCOON CHARACTER(S) ARE REGISTERED TRADEMARKS OF PC CONNECTION, INC. MARLOW, NH.

SUMMARY OF FEATURES

Products listed in alphabetical order ■ = YES □ = NO	Poly NB433DX	Sharp PC-6881	Sharp PC-7750	Swan 486/SLC-25 Notebook	Tenex Notebook 386DXL/33
List price (*PC Magazine* configuration)	$2,240	$3,399	$3,607	$2,393	$1,538
Processor type and speed	Intel 486DX/33	Intel 386SL/25	Intel 486DX/33	Cyrix Cx486SLC/25	AMD Am386DXL/33
Hard disk capacity	130MB	80MB	124MB	117MB	80MB
Dealers/Direct-distribution channel	■■	■□	■□	■■	■■
Dimensions (HWD, in inches)	2.4 x 11.4 x 8.5	1.8 x 11 x 8.5	1.6 x 11 x 8.6	1.9 x 11 x 8.5	2 x 12 x 9.5
System weight/travel weight (pounds)	7.1, 8.7	5.7, 7.2	6.1, 7.5	6.2, 7.6	7.4, 8.7
Display area and diagonal (inches)	5.8 x 7.7, 9.5	5.3 x 6.8, 8.5	5.8 x 7.6, 9.5	5.8 x 7.6, 9.5	5.8 x 7.6, 9.5
Keys: total, function, cursor	85, 12, 8	79, 12, 4	84, 10, 8	80, 10, 4	83, 10, 8
Type of pointing device installed	Built-in	Built-in	Built-in	None	None
Motherboard					
Motherboard manufacturer	MLT	Sharp	Twinhead	Samsung	Nodestar
Chip set manufacturer	ACC Micro	Intel	ACC Micro	Intel/VLSI	ACC Micro
BIOS version (or date)	AMI (1/7/92)	Phoenix reference ID 42	Phoenix 1.01	Phoenix 1.00	AMI (4/13/92)
Setup in ROM/Password in ROM	■■	■■	■□	■■	■■
System shadowing/Video shadowing	■■	■■	■■	■■	■■
Memory and Disk Drives					
Installable RAM	4MB–16MB	2MB–8MB	4MB–20MB	2MB–8MB	2MB–12MB
User-installable	■	■	■	■	■
External processor RAM cache	32K	16K	None	None	32K
Available hard disk sizes	130MB–200MB	80MB–120MB	124MB	60MB–120MB	80MB–210MB
I/O and Expansion					
Parallel, serial, mouse, expansion ports	1, 1, 1, 1	1, 1, 0, 1	1, 1, 0, 1	1, 1, 1, 0	1, 1, 0, 1
High-speed parallel/serial support	□■	□□	□□	□□	□■
Ports for port replicator/expansion chassis	□■	□■	□□	□□	□□
PCMCIA slots	None	One Type II	None	None	None
Internal modem installed	2,400-/9,600-bps fax	None	2,400-/9,600-bps fax	2,400-/9,600-bps fax	None
Video					
Screen/Video chip set manufacturer	Sharp/Cirrus	Sharp/C&T	Sharp/Cirrus	Sharp/Cirrus	Toshiba/C&T
Simultaneous external display	■	■	■	■	□
Maximum internal resolution	640 x 480	640 x 480	640 x 480	640 x 480	640 x 480
Maximum internal gray shades/colors	32, N/A*	N/A*, 16	64, N/A*	64, N/A*	64, N/A*
Maximum external resolution	800 x 600	800 x 600	800 x 600	640 x 480	800 x 600
Maximum external colors	16	16	16	256	16
Illuminated screen/Active matrix	■□	■■	■□	■□	■□
AC Adapter and Battery					
AC adapter size (inches)	2.1 x 3 x 6.4	1.9 x 3.7 x 6.5	1.5 x 2.8 x 6	1.9 x 3.3 x 4.8	1.5 x 2.5 x 6
Rated battery life (hours)	2	1.5	2.5	5.5	3
ZDigit Rundown, Battery Rundown (hr:min)	2:06, 1:18	1:10, 0:46	2:34, 1:55	2:48, 1:55	4:12, 3:11
Charge time while on, off (hours)	4, 3.5	8, 2	2, 2	5, 5	8, 3
Battery weight, amp/hour rating	1.2 lbs, 5Ah	0.8 lbs, 1.8Ah	1.3 lbs, 1.7Ah	1.2 lbs, 2.4Ah	1.9 lbs, 1.7Ah
Display/hard disk power-down	■■	■■	■■	■■	■■
CPU/peripherals power-down	■□	■■	□□	■■	■■
Standby/Hibernation	■□	■□	■□	■□	■□
Miscellaneous					
DOS 5.0, Microsoft Windows 3.1	■■	■□	■■	■■	■□
Warranty	1 year	1 year	1 year	1 year	1 year
First year on-site service charge	N/A*	N/A*	N/A*	N/A*	N/A*
FCC Class B identification number	JXUMLT486PLUS	APYNAR0033	FKGSLIMNOTE-486	A3LS3800	GS6NP-933

N/A*—Not applicable: The product does not have this feature
BSI—Broadax Systems Inc., C&T—Chips & Technologies Inc., DIT—Display Technologies Inc., NTC—Nan Tan Computer Co., VLSI—VLSI Technology Inc., WD—Western Digital

ENDS

TI TravelMate WinSLC	TI TravelMate 4000 WinDX2/50	Toshiba T4400C	Transource Verxion NB8004	U.S. Professional Notebook 486DX
$2,278	$3,899	$3,999	$1,475	$2,775
Cyrix Cx486SLC/25	Intel 486DX2/50	Intel 486SX/25	AMD Am386SXL/25	Intel 486DX/33
64MB	128MB	120MB	82MB	212MB
■■	■■	■■	■■	■■
2 x 11 x 8.5	2 x 11 x 8.5	2.3 x 11.8 x 8.4	2 x 11 x 8.5	2.4 x 11 x 8.5
4.3, 6.8	4.4, 6.9	7.9, 9.8	6.9, 8.1	6.4, 10.3
6 x 8, 9.6	6 x 8, 9.8	5.7 x 7.6, 9.5	6 x 8, 10	5.3 x 6.8, 8.5
79, 10, 4	79, 10, 4	82, 12, 8	80, 10, 4	82, 10, 4
Clip-on	Snap-on	None	Free-standing	None
TI	TI	Toshiba	Transource	Nan Tan
TI	TI	Toshiba	C&T	C&T/ETEQ
Phoenix 1.01	Phoenix 1.01	Toshiba (10/7/92)	AMI (11/15/91)	Award (11/22/89)
■■	■■	■■	■□	■■
■■	■■	■□	■■	□□
2MB–6MB	8MB–20MB	4MB–20MB	1MB–16MB	4MB–16MB
□	□	■	□	□
None	None	None	None	None
60MB–120MB	200MB	120MB–200MB	40MB–130MB	80MB–240MB
1, 1, 1, 1	1, 1, 1, 1	1, 1, 1, 1	1, 1, 1, 1	1, 2, 0, 1
□□	□□	□□	□□	□□
□■	□■	□■	□□	□■
None	None	None	None	None
2,400-/4,800-bps send-only fax	2,400-/4,800-bps send-only fax	None	None	None
Sharp/Cirrus	Sharp/Cirrus	DTI/WD	Hitachi/Cirrus	NTC/NTC
■	■	■	□	■
640 x 480	640 x 480	640 x 480	640 x 480	640 x 480
64, N/A*	64, N/A*	N/A*, 256	32, N/A*	64, N/A*
640 x 480	1,024 x 768	640 x 480	800 x 600	800 x 600
16	16	256	256	16
■□	■□	■■	■□	■□
1.5 x 6 x 2.3	1.5 x 6 x 2.3	1.8 x 6.3 x 3	1.8 x 4.5 x 2.8	2.4 x 6.5 x 3
4	4.5	3	3	3
5:08, 3:10	5:21, 3:05	3:44, 2:19	4:11, 2:52	2:07, 1:39
4, 4	4, 4	1.5, 1.5	8, 8	3, 3
1.3 lbs, 5.7Ah	1.3 lbs, 5.7Ah	2.4 lbs, 2.4Ah	1.4 lbs, 2.8Ah	2.2 lbs, 2.8Ah
■■	■■	■■	■■	■■
■■	■■	■■	■□	■□
■□	■□	■■	■□	■□
■■	■■	■□	■■	■■
1 year	1 year	1 year	1 year	1 year
Included	Included	N/A*	N/A*	N/A*
A92TSLC25	A92486DX2	CJGUK906	ITGHB2200SX-25	FMA3500

the units are solid and well-made. The high-end WinDX2/50 shone brightly on our tests, placing either first or second on all but the DOS video suite—an impressive showing for such a super-light system (6.9 pounds with battery and AC adapter). Its Intel DX2/50 yielded a first-place processor score despite the lack of a secondary cache. The memory score was also high, thanks to TI's proprietary memory modules, and the DOS video score was among the top third. For Microsoft Windows users, performance was top-notch: Credit for a Graphics Win-

FACT FILE

TI TravelMate 4000 WinDX2/50

PC MAGAZINE EDITORS' CHOICE

List price: $3,899.

Tested configuration: Intel 486DX2/50, 8MB 60-ns RAM, 128MB Seagate ST9144A IDE hard disk, 1.44MB floppy disk drive, 2,400-/9,600-bps data/send-only fax modem, DOS 5.0, Microsoft Windows 3.1, Microsoft BallPoint with QuickPort connection, carrying case.

Options: 4MB RAM upgrade, $279; docking station, $999; 14,400-/9,600-bps data/fax modem, $689; network adapters, $469 to $899; battery charger, $149; extra battery, $89.

In short: With a powerful CPU, the WinDX2/50 was a top performer on our benchmark tests, and approaches desktop performance in some.

TI TravelMate WinSLC

List price: $2,278

Tested configuration: Cyrix Cx486SLC/25, 2MB 70-ns RAM, 64MB Seagate ST9077A IDE hard disk; other components same as in WinDX2/50.

Options: Same as for WinDX2/50.

In short: The TI TravelMate WinSLC is attractively priced but its performance was midrange or below.

Texas Instruments Inc., P.O. Box 202230, Austin, TX 78720-2230; 800-527-3500, 817-771-5856; fax, 817-774-6660

408 ON READER SERVICE CARD

Gulliver Travels

Seeking to combine the best of both worlds, the Orchid Gulliver melds many of the superior stylistic cues and ergonomic features of the Apple PowerBook with the PC's inexpensive hardware and its plethora of off-the-shelf software. Sold by the video board maker, Gulliver makes a bold statement, coming in hunter green or blackberry, or charcoal gray for the traditionalists among us. At a travel weight of 7.2 pounds—nearly a pound less than the average for this group—Gulliver was clearly designed for the road, and its nickel cadmium battery lasted over 2 hours of stop-and-go computing.

The user is immediately drawn to Gulliver's built-in trackball, which is placed slightly left of center, in front of the keyboard. The hand comfortably rests on the front ledge of the case, and easily controls the larger-than-usual ball surrounded by actuation buttons. After a few minutes of self training, the outer edge of the thumb automatically touches the ball, while the index fingers tap the buttons with ease. Whether the application is a spreadsheet, a word processing package, or an occasional game of electronic Solitaire, the trackball's action is effortless. This is particularly the case for drag-and-drop operations, which can be an exercise in frustration with other built-in trackballs we've seen and used.

The two prototypes we looked at were of exceptional fit and finish, nearly indistinguishable from production quality. With benchmark performance that was well within the range for other Cyrix Cx486SLC/33–based systems (Orchid Technology also offers an AMD Am386SXL/33 CPU), Gulliver provided only one surprise. The battery on one early unit refused to charge, due to a burned-out resistor; the company fixed this problem. Orchid says it plans to start shipping Gulliver this spring.—*Brian Nadel*

Gulliver borrows many PowerBook features.

DON'T GIVE MONEY TO STRANGERS.

Before you give to a heart organization, make sure it's one you trust: The American Heart Association. Since 1924 we've sponsored lifesaving education programs and funded $900 million in research. Others may copy us, but they can't hold a candle to our heart and torch. To learn more, contact the American Heart Association, 7320 Greenville Ave., Box 20, Dallas, TX 75231.

You can help prevent heart disease. We can tell you how.

American Heart Association

This space provided as a public service.

It goes every place. Even first place.

With so many notebooks to choose from, suddenly everything has fallen into place. *PC/Computing* has just named the IBM ThinkPad™ 700C their 1992 Color Portable MVP. Not COMPAQ.® Not Toshiba.®

In fact, ThinkPad has so much going for it, they said the 700C was "an easy choice for MVP." They also said ThinkPad "comes with one of the shrewdest keyboard layouts available" and with TrackPoint™ II, a built-in mouse that "offers better control than just about any we've seen."

But don't just take their word for it. For more information or an IBM dealer near you, call 1 800 772-2227. In Canada, call 1 800 465-7999. Compared to other color notebooks, ThinkPad is everything you were looking for in the first place.

IBM is a registered trademark and ThinkPad and TrackPoint are trademarks of International Business Machines Corporation. *PC/Computing* and the *PC/Computing* logo are registered trademarks of Ziff-Davis Publishing Company. COMPAQ is a registered trademark of Compaq Computer Corporation. Toshiba is a registered trademark of Toshiba America Information Systems, Inc. © 1993 IBM Corp.

IBM®

CIRCLE 024 ON READER SERVICE CARD

mark score that was more than twice the average goes, in part, to the Cirrus Logic GD6420 chip set.

The less-powerful WinSLC, which is based on a TI-licensed Cyrix Cx486SLC/25 processor, scored in the middle or bottom third of the group on most of our tests. Other differences in components include a Texas Instruments rather than an Intel memory cache and a 64MB hard disk instead of a 128MB Seagate.

The keyboard lacks a built-in pointing device, so both units used clip-ons: The WinSLC came with a TravelPoint clip-on trackball; the 4000 DX2/50 had a Microsoft BallPoint cordless trackball with QuickPort connection. The PgUp, PgDn, Home, and End keys are embedded in the cursor keys and are activated with an Fn key. All function keys are half-height.

An expansion station that connects to a 32-bit port on the back of these units has three drive bays, three full-size ISA slots, and a PS/2 compatible, 101-key keyboard connector. TI also supplies an optional Ethernet adapter. You can upgrade the machine's memory on your own, but it's not easy.

If you like to take your notebook with you whenever you step out of the house, these TI machines are an unbeatable value because of their low weight and exceptional battery life. On our Battery Rundown tests, both of the TravelMates bettered 3 hours of battery life, with the Cyrix SLC-based machine outlasting the other by 7 minutes. The DX2/50 TravelMate includes a power-conservation feature that shuts down the CPU between keystrokes, which also generates less heat.—*AC*

Toshiba America Information Systems Inc.

Toshiba T4400C

The T4400C is the newest incarnation of Toshiba's award-winning T4400SXC laptop (see *PC Magazine,* December 22, 1992), and it has a list price about $2,000 lower. Priced at $3,999, the unit also distinguishes itself with a 9.5-inch bright and brilliant active-matrix display.

The Toshiba system's other positives and negatives remain basically the same. Its keyboard is still king among laptop input devices, and the construction and feature set of these notebooks remain almost unparalleled.

Toshiba T4400C

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	GOOD
Windows applications	GOOD
Desktop replacement	GOOD
VENDOR SERVICE & RELIABILITY	
Overall Reliability	ABOVE AVERAGE
Repair Satisfaction	AVERAGE
Tech Support satisfaction	AVERAGE

Its weight is about 8 pounds with the battery installed. While this might be heavier than you would want, the PC's feature set and active-matrix color make up for it.

That same plump power cell is also responsible for the unit's excellent battery life. The Toshiba clocked in at 2 hours 19 minutes on our Battery Rundown test,

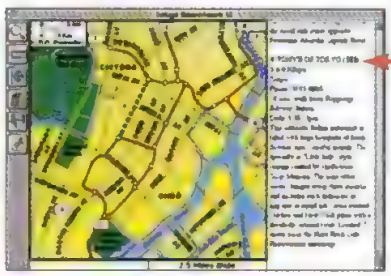
IT'S THE BEST PIZZA JOINT IN TOKYO.

(But how would you know that?)

Goat cheese and grilled octopus?

Okay, it's not what you'd expect to find on your ordinary pizza. But then again, you don't go to Tony's of Tokyo for ordinary pizza. Of course if you had LOCAL EXPERT™, you'd already know that.

"LOCAL EXPERT?" Yes, it's the new software package that gives you all the travel tips and inside information you'll ever need. It's the food critic, business resource, nightlife review and sports directory all rolled into one. And, best of all, it's rolled tight enough to fit easily onto your laptop computer.



All the details come with easy to read maps.

LOCAL EXPERT comes with an extensive collection of world and regional maps, plus lots of useful information. Order now, and you'll get LOCAL EXPERT for the special introductory price of just $99. And that includes a detailed guide to the city of your choice from over 100 cities worldwide. To order, just call 1-800-442-8887. After all, it's not a lot of dough.

LOCAL EXPERT™

1-800-442-8887

STRATEGIC MAPPING

THE MAPPING SOFTWARE EXPERTS™

$99

Available for Macintosh™ computers & PC compatibles running Microsoft® Windows™. Unconditional 30 day money back guarantee. AE, MC & VISA accepted. All trademarks and registered trademarks are of their respective owners. Strategic Mapping, Inc. 3135 Kifer Rd., Santa Clara, CA 95051

FACT FILE

Toshiba T4400C

Toshiba America Information Systems Inc., 9740 Irvine Blvd., Irvine, CA 92718; 800-334-3445, 714-583-3000

List price (tested configuration): $3,999

Tested configuration: 4MB 65-ns RAM, 120MB Conner MK2124FC IDE hard disk, 1.44MB floppy disk drive, DOS 5.0.

Options: With 486DX processor, $4,698; 4MB RAM upgrade, $369; 8MB RAM upgrade, $699; extra battery, $399; docking station, $849; 2,400-/9,600-bps data/fax modem, $289; external floppy disk drive, $399; numeric keypad, $79; battery charger, $289; 12-volt battery adapter, $139; SCSI interface, $279; computer lock, $69; fabric carrying case, $79; leather carrying case, $125.

In short: With an even lower price tag, a larger LCD panel, and the same racy performance and solid ergonomic construction as the last time we reviewed it, the Toshiba T4400C remains a very strong contender

489 ON READER SERVICE CARD

with power saving disabled, and 3 hours 44 minutes on our ZDigit Rundown test, with power saving enabled.

Nevertheless, we would we still like to see flash-upgradable BIOS and perhaps an external processor cache, in case someone would like to upgrade to a 486DX2/50 CPU. The unit's Intel 486SX/25 processor does just fine for most operations, though Toshiba does offer a DX version of this notebook. The SX CPU managed top-ten performance on our benchmark tests, as did the unit's memory subsystem and video chip set—though only under DOS for this last one. The hard disk managed good DOS disk scores, and its Windows disk scores slid into the top ten.

Toshiba offers a one-year parts-and-labor warranty and toll-free technical support.—*OR*

Transource Computers

Transource Verxion NB8004

When seven-pound, 25-MHz, 386SX-based notebooks first appeared, you may have said "I think I'll wait until the price drops to around $1,500 before I buy one." Well, your day may be at hand.

While its competitors seem to be tripping over one other in an attempt to get full-blown, 486-based color notebooks to market, Transource Computers is shipping what amounts to yesterday's average computer today at the super-saver price of only $1,475.

Transource Version NB8004

SUITABILITY TO TASK	
Road warrior comm.	GOOD
DOS applications	FAIR
Windows applications	FAIR
Desktop replacement	FAIR

The Transource Verxion NB8004 can be fairly described as average and unremarkable in just about every sense since it offers absolutely nothing you couldn't have gotten in a portable computer a year or two ago. The major exception is its price. The Verxion's size seems slightly larger than usual, but the 6.9-pound weight is acceptable enough, as is its AMD 386SXL/25 processor.

The Toshiba's keyboard is still king among laptop input devices, and the construction and feature set remain almost unparalleled.

I/O ports include the usual single serial, parallel, and a useful SCSI port, as well as an external VGA adapter that supports 800-by-600 resolution and 256 colors. The system's 85MB Toshiba hard disk can be upgraded to a maximum of 130MB. More recently fashionable features such as PCMCIA slots or an internal pointing device are, as you might ex-

For Those Hard Choices.

ISBN: 1-56276-082-3
Price: $19.95

Negotiating today's crowded hardware scene isn't easy. That's why *PC Magazine* and John C. Dvorak have teamed up to produce *PC Magazine 1993 Computer Buyer's Guide.* It's your one-stop source for unbiased analyses and easy-to-read comparison charts for hundreds of PCs, monitors, printers, input devices, and modems, all benchmark-tested in the world's most modern computer research facility. Combining the latest laboratory results from *PC Magazine* with Dvorak's no-holds-barred commentary, *PC Magazine 1993 Computer Buyer's Guide* is an indispensable shopper's companion that will save you money and help you find the hardware that meets your computing needs.

Available at fine bookstores, or call
1-800-688-0448
ext. 8409

ZIFF-DAVIS ZD PRESS

© 1992 Ziff-Davis Press

pect on a notebook at this low price, conspicuously absent.

The Verxion's AC adapter brick also mirrors the larger and clunkier power-supply units of yesteryear that have been replaced by units of svelter dimensions. In addition, no internal modem options are available for this unit.

Performance was disappointing: The 486-based units of this test group easily outdistanced this contender and even the 386-based competition in this review outperformed it. All of the Verxion's scores on PC Magazine Labs' suite of performance tests were in the bottom quarter of this test group, except for its battery times, which were very competitive. At 2 hours 52 minutes on the Battery Rundown test, the Verxion managed one of the better times we saw. The unit's ZDigit Rundown test score was just as impressive, coming in at 4 hours and 11 minutes.

Transource offers a one-year parts-and-labor warranty that does not include on-site service.—*OR*

FACT FILE

Transource Verxion NB8004

Transource Computers, 2033 West North Ln., #18, Phoenix, AZ 85021; 800-486-3715, 602-997-8101; fax, 602-997-8886

List price: $1,475.

Tested configuration: 4MB 70-ns RAM, 85MB Toshiba MK2024FC IDE hard disk with 32K buffer, 1.44MB floppy disk drive, 12-volt battery adapter, DOS 5.0, Microsoft Windows 3.1, mouse, carrying case.

Options: 130MB hard disk, $200; 4MB RAM upgrade, $95; extra battery, $80; extra AC power adapter, $60.

In short: The Transource Verxion NB8004 would have been a competitive notebook a year ago, but today its feature set looks small and its performance is relatively weak. This portable's price is its only attractive feature.

490 ON READER SERVICE CARD

U.S. Systems and Technologies Inc.

U.S. Professional Notebook 486DX

U.S. Systems' notebook costs $2,775 and arrives in a case seen previously with many a low-cost product from lesser-known vendors such as Aspen Computer and Ergo Computing. Though packing a powerhouse processor, the notebook suffers from a decided lack of forethought in the chip's implementation, as well as from the same shortcomings found in other systems with this case.

U.S. Professional Notebook 486DX

SUITABILITY TO TASK	
Road warrior comm.	FAIR
DOS applications	EXCELLENT
Windows applications	FAIR
Desktop replacement	GOOD

The case's problems revolve mainly around size. Even without its battery, it's slightly larger than other notebooks. It's also heavier. The battery screws onto the back of the system, adding 2.1 inches and 2.17 pounds. Though the keyboard has fairly full-size keys with decent response, the weight of the case, combined with the noticeable noise the unit makes, will make you envy notebooks with more state-of-the-art housings.

The Transource Verxion can be fairly described as average and unremarkable in just about every sense. The exception is price.

U.S. Systems didn't seem to think about the consequences of adding a 486DX/33 processor. There's no external processor cache, and the company offers no upgrade path to a 486DX2/66. Even if it did, you'd soon experience the same heat problems we experienced with the DX/33. Since there is no shielding, provisions for air flow, or a low-power and cool-operating chip set, using this notebook for an extended time will result in uncomfortable heat buildup. Be sure to have a separate work surface handy.

FACT FILE

U.S. Professional Notebook 486DX

U.S. Systems and Technologies Inc., 15041 Bake Pkwy., Unit L, Irvine, CA 92718; 800-872-7239, 714-580-1700; fax, 714-580-1701

List price: $2,775.

Tested configuration: 4MB 70-ns RAM, 212MB Maxtor 7213A IDE hard disk with 64K buffer, 1.44MB floppy disk drive, numeric keypad, DOS 5.0, Microsoft Windows 3.1, Fastback, Untouchable, carrying case.

Options: 4MB RAM upgrade, $200; 12MB RAM upgrade, $550; trackball, $79; docking station, $215; extra battery, $110; 2,400-/9,600-bps data/fax modem, $150; Ethernet network adapter, $195; ARCnet LAN packARCnet network adapter, $100; external floppy disk drive, $250; external keyboard, $35; battery charger, $35; 12-volt battery adapter, $45.

In short: With an outdated case, an ill-planned implementation of a powerful processor, and an unexceptional price, the U.S. Professional Notebook 486DX is difficult to recommend.

491 ON READER SERVICE CARD

Performance was high as expected from this kind of processor/hard disk combination, and all test scores involving these components were in the top ten. Graphics results were below average under DOS and above average under Windows. Battery times were less impressive due to the power-hungry 486DX/33: 1 hour 39 minutes on our Battery Rundown test, with power saving disabled, and 2 hours 7 minutes on our ZDigit Rundown test, with power saving enabled.

U.S. Systems offers a one-year parts-and-labor warranty but does not offer on-site service.—*OR* □

Port™: the best cradle for your notebook

Swiss made Handle :

Designed for maximum grip and comfort, Port's Swiss made handles are ergonomically contoured on the inside and reinforced with metal on the outside

Shock absorption system :

The difference is, where others simply pad your notebook, we quite literally defend it. SafePort™ actually cradles your notebook, suspending your computer on a cushion of air that works like a shock absorber to deflect and protect your computer from whatever the road can throw your way.

Metal fittings :

Tough metal hardware anchor both the straps and the contoured handles, heavy duty nylon zippers provide durability and dependability.

High Tech microline :

Our cases are constructed with an outside layer of high tech microline nylon and padded underneath with impact resistant closed cell foam to further cushion and protect your computer.

Colors Available :

Black

Burgundy

Gray

Ergostrap :

The straps are ergonomically designed to hold the contour of the human shoulder while twin strap adjustments keep the bag centered and stable.

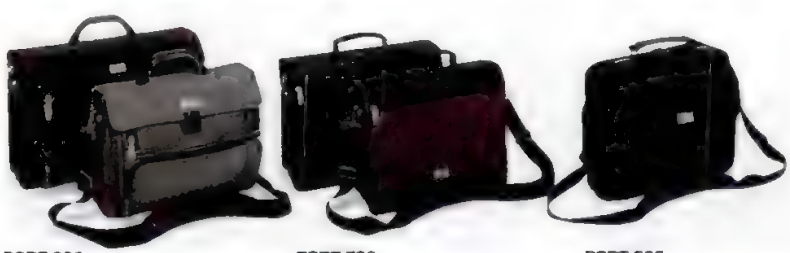
Our cases are designed and engineered to hold all of the items you need to carry. Along with your computer there is room for a printer, A/C adapter, phone and spare batteries. Plenty of pockets are conveniently located for pens, calculators, note pads, magazines and other miscellaneous items.
Port™... A completely unique line of cases distinguished by incomparable design, unmatched quality and an unbending attention to the smallest details.

To order today for immediate delivery, call

☎ **1.800.242.3133**

The PORT promises :

- **We offer a lifetime limited warranty to the original owner.**
- **If not satisfied, return within thirty days.**
- **Fits all sizes of NoteBook computers.**



PORT 886
Colors : Black, Burgundy, Gray
Styles : **886L** : L 18", H 13", W 7"
$189.00
886S : L 14", H 11", W 6"
$159.00

PORT 786
Colors : Black, Burgundy, Gray
Styles : **786L** : L 16", H 15", W 6"
$169.00
786S : L 14", H 15", W 5"
$149.00

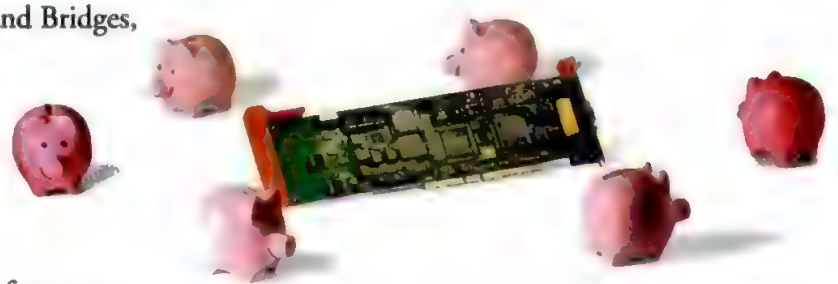
PORT 586
Colors : Black
Style : **586** : L 13", H 12", W 5"
$59.00

PORT
The Difference

CIRCLE 097 ON READER SERVICE CARD

Ever dream about how much you'd save if your server could do the work of 6 ?

Good news, now you can stop dreaming and start saving. Only Madge gives your IBM Model 95 or RS 6000 servers the power of 6. Six Madge Smart 16/4 MC32 Ringnodes can be added to one machine with no performance degradation. So, now your server can do the work of six. They deliver twice the data transfer rate of any other card on the market, up to 40 megabytes per second. Madge offers complete high performance Token Ring solutions: from Network Management tools, to Hubs and Bridges, to the broadest range of Token Ring adapters. But Madge gives you more than the industry's highest performance.



We also provide the industry's leading support with free access to our technical engineers, on-site support when you need it, 24-hour access to the Madge Bulletin Board, MadgeFAX services, a 30-day satisfaction guarantee, and a full 5-year warranty.

Call 1-800-TR-MADGE (800-876-2343) today and get your server to do the work of 6.
See Us At Interop Booth #1614

CIRCLE 098 ON READER SERVICE CARD

MADGE

ENTERPRISE CRITICAL NETWORKING

Building the Highway

Manageability, not speed, is crucial among routers. We look at the management and performance features of 10 leading routers.

by Scott Bradner and David Greenfield

It didn't seem like much at first. After all, an occasional disrupted terminal session is hardly news. But when important users started complaining about not receiving electronic mail, IS managers at Gannett Publications, a subsidiary of Gannett Co., knew they had a problem.

Engineers began digging and soon found the culprit. A flood of traffic was saturating the phone line connecting the New York office to Gannett's Arlington, Va., headquarters. With the lines clogged, the AS/400 based in nearby Maryland was unable to poll the terminals in New York. Sessions were being dropped and electronic mail was being lost.

Faced with the prospect of spending from $4,000 to $5,000 more per month on a faster data line between New York and Virginia, Gannett instead chose to pass the data between its networks more intelligently. Routers were installed at both LANs to control the movement of data across the network.

Gannett isn't the only company to manage its wide-area network (WAN) through a combination of routers, internetwork-

IN THIS REVIEW

ACS 4200 244
Cisco AGS+/4 245
Constellation Pixis 248
HP Router ER 249
IBM 6611 Network Processor 140 252
NSC 6607 Bridge-Router 259
Novell MultiProtocol Router, Version 2.0 264
Proteon ProNet DNX-300m 266
NETBuilder II 269
Network 9000 Intra-Networking Hub 270

Illustration by Mark Matcho

HIGHLIGHTS

Routers

WE EVALUATED TEN products from ten vendors: Advanced Computer Communications, Cisco Systems, Clearpoint Research Corp., Hewlett-Packard, IBM Corp., Network Systems Corp., Novell, Proteon, 3Com, and Xyplex. All of the products support Ethernet networks running TCP/IP and IPX. All run RIP and most run OSPF as their routing protocols.

ROUTERS AND BRIDGES are the two devices used to connect networks. *Routers* forward packets based on their network address while *bridges* forward packets based on their station address.

SECURITY, RELIABILITY, cost-savings, and network planning are the critical reasons for purchasing a router. Since the router looks at more information in a packet than a bridge does, it is better able to control where data will flow on the network. This not only implies tighter security and enhanced reliability, but in the case of remote connections, additional cost-savings. And with the information gathered by the router, more effective network planning becomes possible.

THERE ARE TWO TYPES of routers: central and peripheral. Central routers sit at the core of a network, connecting many network workgroups. They offer many protocols and interfaces, high reliability, strong performance, and sophisticated management. Pricing and ease of use are less crucial, although the need for the latter is changing. Peripheral routers connect individual workgroups to a local backbone or to a remote site. These are smaller products, connecting one or two networks with one or two protocols. Pricing and ease of use are crucial.

EASE OF USE AND INSTALLATION are the biggest problems facing router vendors today. IBM's 6611 was the easiest of the routers to install and configure. Proteon's DNX-300m and Clearpoint's Pixis were the easiest to bring on-line of the peripheral routers.

VENDORS ARE LOOKING AT NEW ways of making routers easier to use. Several vendors, including Cisco, offer new management applications that make the management information more understandable. As for configuration and installation, 3Com, for example, recently announced its Boundary Routing System (BRS), which lets peripheral routers get complex configuration information from central routers and not from the local network manager.

PERFORMANCE is less of an issue than ease of use, manageability, and interoperability. Still, there were some interesting performance findings. IBM's 6611 was the only product to exhibit near-perfect scalability. Since the IBM's I/O cards each have their own processors, the unit's performance increased in direct proportion to the number of cards in the unit.Cisco's AGS+/4 had the best performance overall, but bridging was still surprisingly low on six streams.

ing hardware, and software that intelligently passes data back and forth across LANs and wide-area digital connections.

Routers embody the idea of intelligent, elegant control of a network. They dynamically move select packets of data between two or more networks. The devices examine the network addresses on each piece of data they receive and then send that data to any of a variety of destinations. They may, for example, move the data to other stations on the LAN that originally sent the data, to other LANs connected to the router, or onto digital data connections to other routers.

In effect, a router treats a WAN as a composite of several smaller networks. It's a simple approach that makes WAN troubleshooting, cost accounting, and planning far easier and more effective.

Routers, for example, enable the network manager to prevent data created by certain applications or users from leaving or entering the network. Such control is precisely what Gannett needed. Because most of the flood of data clogging the company's data link was nonessential, restricting access to the remote link let the router use the existing line's bandwidth more effectively.

By enabling network managers to determine how data is to be forwarded, routers provide added security, reliability, and management capability. Line usage can be more cost efficient, and network planning can be simplified.

Routers work in conjunction with other security techniques to improve the integrity of corporate data. They let managers restrict sensitive traffic to a particular LAN, thus protecting valuable information on the LAN from prying eyes. Managers can, for example, ensure that no one outside the accounting department has access to payroll records.

Restricting traffic also makes diagnosing network problems far easier. Managers can focus on troubleshooting independent pieces of a corporatewide network, rather than grapple with the complexity of the larger enterprise network. And the routers themselves assume part of the burden of managing the data. By sharing network information with other routers, the devices can dynamically reroute traffic around a broken

Our Contributors: DAVID GREENFIELD was the associate editor in charge of this story. SCOTT BRADNER is a consultant at Harvard University's Office of Information Technology, Network Services Division. TOMAS KREJCI, the Ziff-Davis Labs Network Platform Manager, is a specialist in internetworking and satellite communications. ROBERT LIPSCHUTZ is a network systems integrator at Ziff-Davis Labs. GEORGE PORNARAS is a data networks engineer at NASA-Ames Research Center in California.

link or route top-priority traffic along the fastest link.

A router's ability to play traffic cop can save money on the expensive, high-speed digital data connections between LANs on an enterprise-wide network. (For more information on WAN costs, see "Linking LANs," March 16, 1993). By managing the traffic that the networks pass, routers can use lines that have less bandwidth—and less cost. Network managers can configure their routers to move less important data across less expensive links.

Network managers can plan their networks' future growth most successfully if they thoroughly understand the patterns of network traffic. As intelligent connectors, routers are the network component best suited to gather such information.

Routers are complex devices. They typically overlay sophisticated proprietary hardware with intricate software. Not surprisingly, this complexity has drawbacks. Expense is the first: Routers typically cost more than bridges. And while bridges are fairly simple to configure and install, routers—even with recent advancements in ease of use—still demand the services of a network engineer.

Developing a router-based infrastructure requires an extensive knowledge of data communications, tempered by a practical understanding of network problems. And with more than 40 manufacturers producing over 100 different models of routers, picking the product best suited for your company can be daunting.

REVIEW CRITERIA

To provide the most useful product evaluations, we settled on a few broad criteria. All of the products reviewed had to connect PCs via Ethernet. Support for multiple network protocols was an obvious criterion; we insisted that all of the products offer the most common workgroup protocol, Novell's IPX (Internet Packet Exchange), and the dominant backbone protocol, TCP/IP (Transmission Control Protocol/Internet Protocol). Routing protocols, the means by which routers share information, were less important. We accepted products that use the Routing Information Protocol (RIP), but gave greater weight to those that supported more sophisticated protocols such

PC MAGAZINE

EDITORS' CHOICE

- **Cisco AGS+/4**
- **Constellation Pixis**
- **IBM 6611 Network Processor 140**
- **Novell MultiProtocol Router, Version 2.0**

No single router provides the ideal blend of price, performance, manageability, and reliability for every wide-area network. With that in mind, we've identified two types of routers (central and peripheral) and three markets to which they are targeted. Multiprotocol, IBM-centric, and Novell-centric networks are the markets we focus on.

We gave our Editors' Choice awards to individual products, not to the product lines of which they are part. You, however, will want to take entire product lines into consideration: Often, the best strategy for purchasing routers is to choose equipment from a single vendor, even if its products are not the most technically advanced. Use our choices as guides for optimizing your selection.

Among the central routers, the best product is the Cisco AGS+/4. Cisco's router offers more interfaces and protocols (including such uncommon ones as SNA) than any other product reviewed. Its performance was exceptional and its management features are strong. The AGS+/4 sets the standard for all routers.

Despite the AGS+/4's impressive SNA capabilities, we recommend the IBM 6611 Network Processor 140 if you need to combine SNA traffic with other types of traffic on a multiprotocol network. The 6611 Network Processor 140 we tested did not support enough networks to be considered a central router. After our testing, however, IBM released a new WAN module with two connections, not one, making the 6611 Network Processor 140 suitable as a central router. In our review, we considered the 6611 as a peripheral router.

The 6611 was also the easiest router to configure and install. The device does lack transparent bridging, a problem that IBM is moving to correct. In the interim, the company provides network managers with source-route bridging.

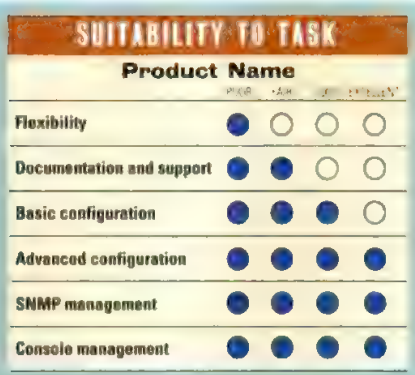
Neither of these products offer the fault tolerance that is becoming more widely available in central routers. The Xyplex Network 9000 Intra-Networking Hub offers the best fault tolerance. But the five-slot Xyplex router we reviewed is closer in size to a peripheral than a central router. (Xyplex does make a 14-slot router, but we did not review that product.) For its configurability and reliability, the Xyplex router gets an Honorable Mention.

Among the peripheral routers, Novell's MultiProtocol Router (with NetWare WAN Links) is the obvious choice for connecting Novell workgroups to a backbone. The Novell product is the sole software-only router we reviewed. It offers strong performance and a range of protocols. Best of all, it can be loaded onto your NetWare server, so you won't have to buy another hardware platform.

If you need to connect a workgroup to a multiprotocol backbone, the clear standout is the Constellation Pixis. The Pixis is one of the least expensive products we reviewed, and it is the smallest. It offers IP, IPX, and XMS support, and easy installation as well. Its fixed Ethernet architecture would normally be a crippling problem, but its unique simultaneous bridge/routing capabilities and excellent performance outshine the competition.

Suitability to Task: Routers

Routers cannot be purchased merely on the basis of performance. Protocol support and flexibility are vitally important. Ease of configuration and management will simplify the operation of the router, and dependable technical support gives the user a safety net.



Flexibility Routers should not limit your networking options. They should let you connect the protocols you want on the networks you want. To show you which routers best accomplish that mission, we examined five types of features: the LAN interface options, the network protocols supported, the WAN interface options, the WAN protocols supported, and the routing protocols supported.

Documentation and support Whether you are new to the field or have experience with a particular router, the amount of help the vendor provides is crucial to getting the router up and running effectively. You want the documentation to be clearly written. You will also want an index, a glossary, an installation section, a technology section, and a quick-reference card. Though we weren't able to measure the quality of each vendor's technical support, there are certain services that the vendor should offer, such as an 800 technical-support number, free 24-hour telephone support, training classes, and on-site technical support.

Basic configuration Even powerful routers need to be configured. As routers move out of the domain of the elite technical analyst into the realm of the traditional corporate network manager, how easily the product can be installed and how easily it can be modified are becoming increasingly important. Configuration concerns include the difficulty of hardware installation, whether the setup interface is menu-driven, whether the software offers on-line help (and if so, whether the help is context-sensitive), and finally whether a quick-configuration option is offered and how much of the configuration it can handle.

Advanced configuration Many network managers will be happy just to get the router installed. Some, however, will want to optimize the router for their particular environments. On one level, this means being able to configure filters for each of the different network protocols. Network managers might also want to filter traffic by application type or give certain protocols priority over other protocols. Extent of protocol support is also important, as in the case of IPX with support for Service Access Point (SAP) filters. As always, ease of setup is important.

SNMP management Once the router is fully installed and configured, it will need to be managed. There are several SNMP management concerns. We looked at ease of use, the range of monitoring tests, support for MIB II variables, support (via private MIBs) for protocols not covered by the MIB II specification, support for SNMP traps, and support for HP OpenView and SunNet Manager.

Console management SNMP is not always the optimum management method. Often you'll need to use a terminal to connect directly to the router. To evaluate console management, we looked at how easy it is to manage the router, support for management tools such as Ping and Traceroute, whether the product is Telnet-capable, and whether Telnet sessions and access can be password-protected.

as Open Shortest Path First (OSPF) or Integrated Intermediate System to Intermediate System (Integrated IS-to-IS). (For definitions of terms concerning routers, see "The Router Glossary.")

Our review consisted of performance tests and evaluations of more subjective factors, such as ease of use. We used the performance tests conducted by the Harvard University Network Device Test Laboratory. Once a year, the Harvard lab issues an open invitation to vendors to participate in its independent series of tests. The invitation is placed on two electronic mailing lists (comp.protocols.tcp-ip and comp.dcom.lans) located on the Internet, a research network closely monitored by router vendors.

More than half of the router vendors have accepted the invitation at least once. The performance data included here is from a series of publicly available tests administered at Harvard from September through October of 1992.

The responding vendors were invited to schedule a test date. Each vendor was required to have a technical representative available on-site for the two to three days of testing. Not all the vendors who initially responded had the resources to meet this requirement. These vendors are not reviewed here.

The Harvard tests were open to all routers, including those that supported only a single protocol. Our review focuses on multiprotocol routers that supporting TCP/IP, IPX, and the TCP/IP RIP routing protocol, and that offer Ethernet and WAN support.

All of the raw data from current and previous Harvard tests are currently available over the Internet from the host hsdndev.harvard.edu (IP address 128.103.202.40) in the directory pub/ndtl. The same directory tree includes copies of all of the scripts used. Results from the tests are also available on CompuServe's Editorial Forum as ROUTER.TXT.

NOT JUST SPEED

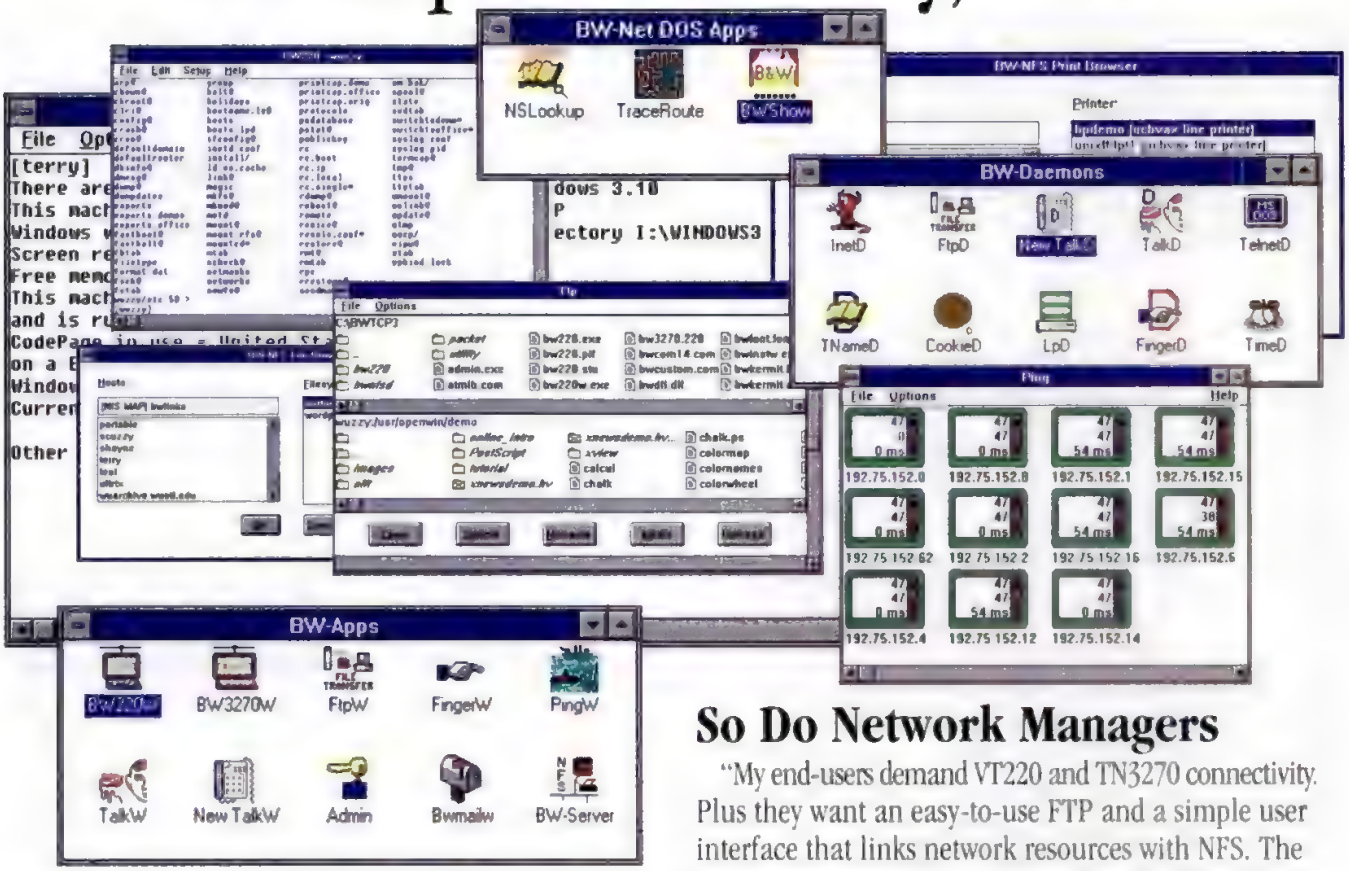
But a router is greater than the sum of its performance numbers. Such factors as simple installation and easy-to-read management information are critical. To evaluate these and other factors, Ziff-Davis Labs conducted additional tests.

Not all the routers in the Harvard performance test were tested at ZD Labs. Wellfleet Communications is one of the companies that participated in the Harvard tests but whose products are not reviewed here. Wellfleet does not offer IPX support on its new Backbone Node. Support for IPX is available on Wellfleet's other routers, but because the company was in the process of revising its management software, it declined to participate.

Though Cisco Systems participated in the Harvard tests, it lacked the additional personnel to be part of the testing at ZD Labs, which also required the presence of a company representative. Because of the company's commanding market share, we decided to run the Cisco 3000, a lower-end router with management capabilities identical to the AGS+/4, through our testing at ZD Labs. All results here are reported for the AGS+/4.

TCP/IP & NFS for DOS & Windows.

More Than User-Friendly. It's Expert-Friendly, Too.



So Do Network Managers

"My end-users demand VT220 and TN3270 connectivity. Plus they want an easy-to-use FTP and a simple user interface that links network resources with NFS. The programmers want SOCKETS and NetBIOS APIs. The network administrators want a package that's not copy-protected, and that's also easy to install and configure. Of course, network managers need SNMP support, NIS, DNS, and HOST naming, as well as support for NDIS, ODI, Packet and SL/IP interface specifications. Finally, it has to tie together with a TCP/IP that coexists with our proprietary networks. Beame & Whiteside does it all.

Users Love It

"Beame & Whiteside's networking software is easy to install, easy to use, and it lets me connect to everything on our network. From logging onto our mainframes to linking printers and sharing disks, it gets me where I want to go. It all runs from either DOS or Windows,™ uses surprisingly little memory, and can be loaded high. You might say Beame & Whiteside turns my PC into a multi-user workstation. Other computer users can access my files, print to my printer and even run applications. It's everything networking software should be."

Call now and they'll send you a *free* 60-day evaluation copy to try on your own network."*

Beame & Whiteside Software Ltd.

The Talk of Your Organization

1-800-INFO-NFS

See us at Interop Booth #1334

CIRCLE 090 ON READER SERVICE CARD

*Offer expires 12/30/93. Windows is a trademark of Microsoft Corporation.

Beame & Whiteside Software Ltd., P O Box 8130, Dundas, Ontario, Canada L9H 5E7, Tel: (416) 765-0822, Fax: (416) 765-0815 ©1993 Beame & Whiteside Software Ltd (004-0)

NSC submitted its 6617 Bridge-Router to ZD Labs for management and the 6607 for performance. With the exception that the 6617 offers an extra WAN port at a higher price, both products are identical.

BEST AND THE BRIGHTEST

We evaluated each router as a separate entity, rather than a part of a product line. Yet buying all your routers from a single company can often be wise. If you are connecting the routers across a WAN link, the connecting routers should almost always be purchased from the same company.

To implement such a strategy, establish the most important router or set of routers in your network, decide on the product that meets your needs, and then purchase that product and all the supporting routers from the same vendor.

The products we reviewed ranged from two-port routers capable of linking only two Ethernet networks, to massive multiport units capable of linking dozens of networks.

We found four particularly outstanding products—Cisco's AGS+/4, Clearpoint's Constellation Pixis, IBM's 6611 Network Processor 140, and Novell's MultiProtocol Router—each of which targets a different set of needs and a different market.

SOMETHING IN COMMON

Beyond our filters, all the routers reviewed have a few other similarities. First, we generally found their user interfaces to be illogical and their commands arcane. Progress is at hand, however. Some vendors, most notably IBM, are actively trying to making their routers easier to manage and install. At least four vendors offer special applications running under a simple network management (SNMP) console, such as SunNet Manager or HP OpenView.

Most vendors represented in this article exceed our router-protocol requirements by using the sophisticated OSPF protocol to share router information. Many smaller networks work just fine with the standard RIP for sharing information between routers, but most of the vendors aim to provide powerful routing protocols for building enterprise networks of several hundred workgroups.

Product features can be grouped into several categories. Among these, network management is crucial. All of the vendors, except for Advanced Computer Communications, support SNMP calls based around Management Information Base (MIB) II. SNMP is a standard for collecting management information from different vendors' products.

SNMP collects information through a management station, a protocol for communicating the information to the management station, and an agent in the device. The agent stores the information in a database, or MIB. Vendors can either use standard MIB definitions (MIB I and MIB II) or supply proprietary extensions. Using MIB II ensures that any SNMP-based management station will be able to read the data. ACC uses proprietary MIB extensions to convey this information.

WAN performance, another important consideration, is determined by the speed of the link. During our testing, the various products were about equal at moving data between locations in one direction. All of the routers were able to support nearly a full 56Kb link between two Ethernet or Token-Ring networks with small and large packets, and a T1 link with large packets.

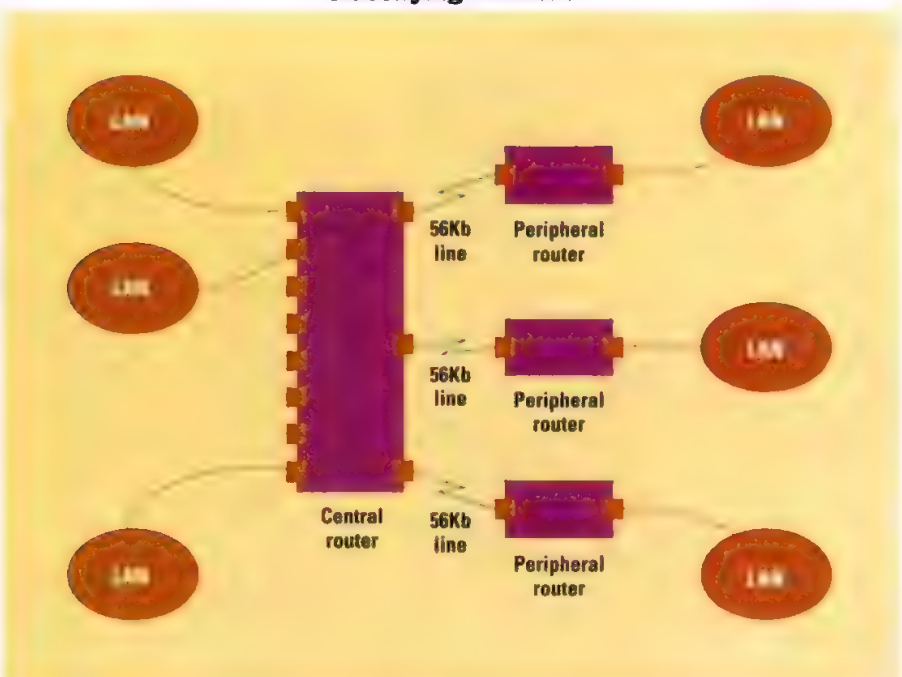
The only exception to this generalization occurred when the products were passing small packets on T1 links. The Proteon and Novell routers were somewhat slower than the rest of the devices. But under normal loads, the mix of packet sizes and the slower speeds of a WAN link would probably make performance differences imperceptible.

Interoperability is another key concern. Though routers from different vendors can, in theory, communicate using the Point-to-Point Protocol (PPP), in fact PPP implementations vary. (PPP is a TCP/IP specification developed by the Internet Engineering Task Force (IETF), the group responsible for enhancing TCP/IP.) All of the routers reviewed offer some PPP support for TCP/IP, and a few have added the extensions that allow PPP to function with multiple protocols.

CENTRAL ROUTERS

The products reviewed in this article, and indeed the products in the market today, mirror the organization of many businesses, in which a corporate headquarters

Classifying Routers



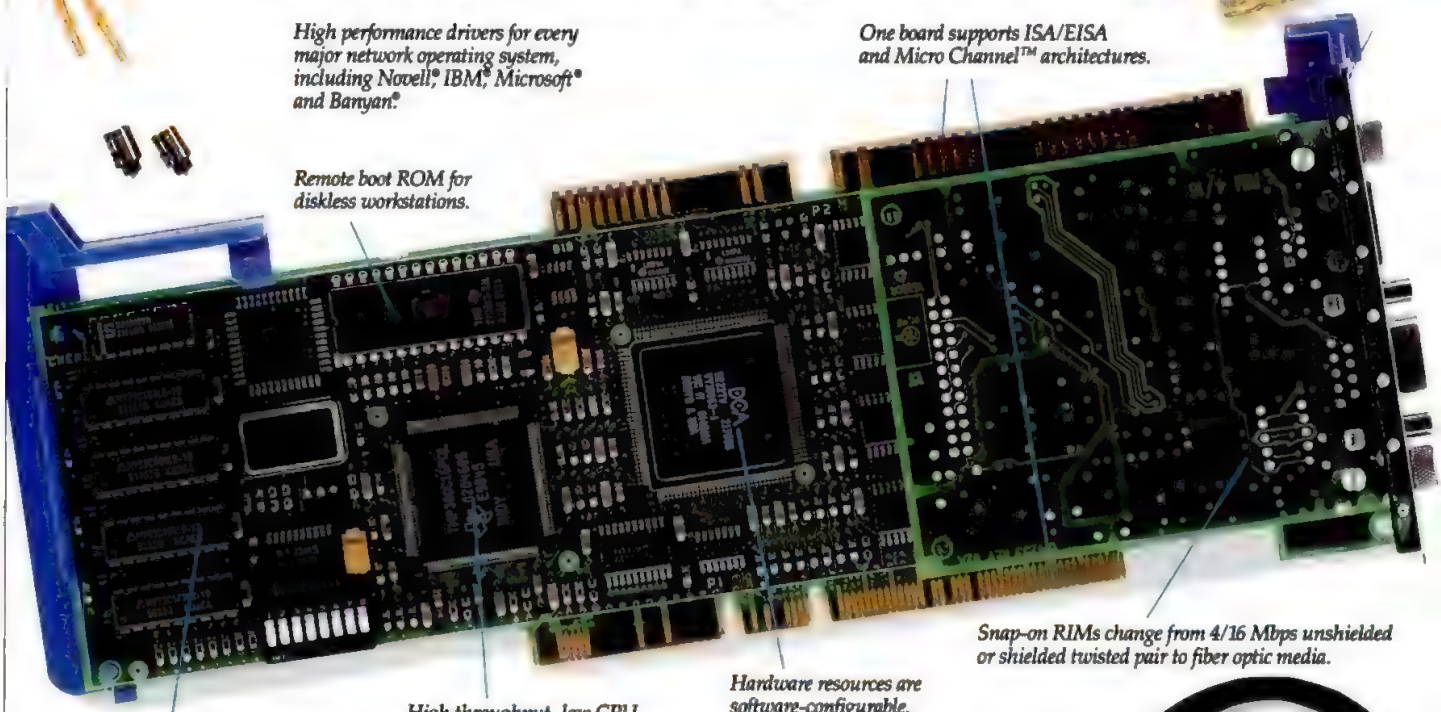
Central routers act as a backbone for the network. They sit at the center, connecting many LANs together. Peripheral routers are much smaller, connecting individual LANs either to a central router or to each other.

WE'D LIKE TO POINT OUT WHY THIS IS THE BEST TOKEN-RING VALUE IN THE WORLD.

High performance drivers for every major network operating system, including Novell,® IBM,® Microsoft® and Banyan.®

One board supports ISA/EISA and Micro Channel™ architectures.

Remote boot ROM for diskless workstations.



Snap-on RIMs change from 4/16 Mbps unshielded or shielded twisted pair to fiber optic media.

Hardware resources are software-configurable.

High throughput, low CPU utilization using Bus-Master DMA technology.

Supports up to 2MB on-board RAM for future enhancements.

Easy, menu-driven install program with on-line help.

If you've read the captions, you get our point. IRMAtrac™ represents the most advanced token-ring engineering in the industry. When you combine that with our new low price of only $695, the result is an unbeatable value.

IRMAtrac has passed conformance tests with major network operating system vendors, as well as principal hub vendors. It's so reliable we back it with a lifetime warranty and the DCAdvantage™ program. And we also offer a Macintosh® board, MacIRMAtrac,™ and a complete family of MAUs.

IRMAtrac is also the only token-ring board that can be used in multiple PC architectures with a variety of cabling. So you only need to purchase and support one adapter, making your life simpler today and protecting your investment in the future.

For a limited time, you can purchase IRMAtrac or MacIRMAtrac for only $425 by calling **1-800-348-3221, ext. 32A.*** We'll even include your choice of IRMA WorkStation 3270 emulation software for Windows,™ DOS, Mac® or OS/2,® free. All with a 60-day, money-back guarantee. Now that we've pointed out what a superior value IRMAtrac is, why buy anything else?

THE FREEDOM TO COMMUNICATE.

DCA

Offer expires March 31, 1993 and is not available to resellers. One unit per customer site. Offer and price good in U.S. and Canada only. Lifetime warranty against defects in materials and workmanship. Call (404) 475-8380 if outside the U.S. © 1992 Digital Communications Associates, Inc. All rights reserved. DCA is a registered trademark and IRMAtrac, MacIRMAtrac and DCAdvantage are trademarks of Digital Communications Associates, Inc. Windows is a trademark of Microsoft Corporation. All other trademarks are property of their respective owners.

CIRCLE 389 ON READER SERVICE CARD **SEE US AT INTEROP BOOTH #114.**

SOFTWARE

Product	Media	Price
Spreadsheets		
❑ Lotus 1-2-3 Windows 1.1 Item #58836-16	F5	$ 315
❑ Lotus 1-2-3 Windows 1.1 Item #61837-16	F3	$ 315
❑ Lotus 1-2-3 Windows 1.1 Upgrade Item #54832-16	F3	$ 99
❑ Microsoft Excel for Windows 4.0 Item #53253-16 (5.25 available)	F3	$ 299
❑ Microsoft Excel for Windows 4.0-Upgrade Item #44625 (5.25 available)	F3	$ 119
❑ Lotus 1-2-3 2.4 Item #67606-16	F3	$ 335
❑ Lotus 1-2-3 2.4 Item #69601-16	F5	$ 335

$99 Lotus 1-2-3 Upgrade

Product	Media	Price
Word Processing		
❑ WordPerfect 5.2 for Windows Item #77919-19 (5.25 available)	F3	$ 275
❑ WordPerfect 5.2 for Windows-Upgrade Item #57683-19 (5.25 available)	F3	$ 79
❑ Microsoft Word for Windows 2.0b Item #64932-19 (5.25 available)	F3	$ 299
❑ Microsoft Word for Windows 2.0b-Upgrade Item #62910-02 (5.25 available)	F3	$ 119
Word Processing Con't		
❑ Lotus Ami Pro 3.0 Item #55236-19	Dual	$ 249
❑ Lotus Ami Pro 3.0 Upgrade Item #32259-19	Dual	$ 99
Database		
❑ Borland Paradox 4.0 Item #63329-08	F3	$ 499
❑ Borland Paradox 4.0 Item #63325-08	F5	$ 499
❑ Borland Paradox 4.0 Upgrade Item #89829-08	F3	$ 185
❑ Borland Paradox 4.0 Upgrade Item #91828-08	F5	$ 185
❑ DataEase Express for Windows Item #85902-11	F3	$ 145
❑ Symantec Q&A 4.0 Item #95743-13	F3	$ 249
❑ Symantec Q&A 4.0 Item #17461-13	F5	$ 249
Presentations/Graphics		
❑ Lotus Freelance Graphics for Windows Item #29190-10 (5.25 available)	F3	$ 339
❑ Lotus Freelance Graphics for Windows-Upgrade Item #00802-10 (5.25 available)	F3	$ 99
❑ Harvard Graphics for Windows 1.01 Item #37744-10	F3	$ 349
❑ Harvard Graphics for Windows 1.01 Item #89734-10	F5	$ 349
❑ Microsoft PowerPoint 3.0 Item #12531-03	F3	$ 299
❑ Microsoft PowerPoint 3.0 Item #82528-03	F5	$ 299
❑ Aldus Persuasion 2.1 Item #77993-03	F3	$ 315
❑ Aldus Persuasion 2.1 Item #83997-03	F5	$ 315
❑ Spinnaker PFS: Publisher for Windows Item #38927-04	F3	$ 89
Integrated		
❑ Lotus SmartSuite Item #71818-13	F3	$ 459
❑ Lotus SmartSuite Item #73818-13	F5	$ 459
❑ Microsoft Office 3.0 Item #36837-13	F3	$ 459
❑ Microsoft Office 3.0 Item #49836-13	F5	$ 459
❑ Spinnaker PFS: WindowWorks 2.0 Item #40941-13	F3	$ 75
General		
❑ Chipsoft TurboTax for Windows Headstart Item #73918-02	Dual	$ 47
❑ Chipsoft TurboTax for DOS Headstart Item #00635-02	Dual	$ 47
❑ Intuit Quicken 6.0 Item #79785-02	Dual	$ 39
❑ Intuit Quicken for Windows 2.0 Item #45870-02	Dual	$ 29
❑ Intuit Quickbooks Item #38392-02	Dual	$ 89
❑ IBM OS/2 2.0 Item #23449-17	F5	$ 139
❑ IBM OS/2 2.0 Item #26442-17	F3	$ 139
❑ Symantec Norton Desktop for Windows 2.0 Item #88164-11	F3	$ 109
General Con't		
❑ Symantec Norton Desktop for Windows 2.0 Item #63129-11	F5	$ 109
❑ Quarterdeck QEMM 386 Item #45010-17	F3	$ 59
❑ Quarterdeck QEMM 386 Item #42019-17	F5	$ 59

PERIPHERALS AND ACCESSORIES

Product	Media	Price
Multimedia		
❑ Creative Labs Multimedia Upgrade Kit Item #30738-25	Int	$ 549
❑ Creative Labs Sound Blaster Pro Item #61991-54	Int	$ 189
❑ MediaVision Pro 16 Multimedia System Item #23507-54	Int	$ 899
❑ MediaVision Multimedia Upgrade Kit Plus Item #38504-54	Int	$ 735
❑ MediaVision Fusion 16 Multimedia Upgrade Kit Item #88934-25	Int	$ 499
❑ MediaVision Pro Audio Spectrum 16 Item #01507-54	Int	$ 199

$239 PFS Printer Bundle: Item PFSPRINT

INTRODUCING DELLWARE. PRICES FROM SOMEONE YO

Same low prices. Same great software and peripherals. So, who would you rather buy them from—some anonymous discounter, or a FORTUNE 500® company like Dell? That's what we thought.

Now in addition to award-winning computers, we offer over 2,400 items for your system (including software, peripherals and accessories), all at everyday low prices. Naturally, all are backed by the unmatched personal support and service Dell is known for. We call this DellWare.™

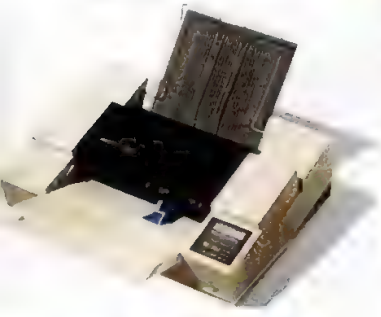
You'll call it a welcome change from combing the backs of your computer magazines for bargains.

Our trained representatives take the time to get to know you and your computer system, and will help you find exactly what you need.

Since you'll want to start using your new products immediately, we'll ship them to you by the next business

FORTUNE 500 is a registered trademark of The Time Inc. Magazine Company. Product availability and prices subject to change without notice. Dell disclaims proprietary interest in the marks and names of

Product	Media	Price
Modems		
❑ Cardinal Technologies 2400 w/Prodigy Kit Item #000666-41	Int	$ 39
❑ Practical Peripherals 2400 SA 9600Fax Item #55492-41	Ext	$ 109
❑ Practical Peripherals 9600 SA w/QuickLink II Item #17710-41	Ext	$ 305
❑ Hayes Optima 96/Smartcard EZ .32/.42BIS Item #60063-41	Ext	$ 349
❑ Cardinal MB14400 V.32 w/Turbofax V.42 Item #40355-41	Ext	$ 309



Lexmark Model 4079 Color Jet Printer

Input Devices		
❑ Logitech Mouseman Cordless Serial PS/2 Item #62063-35		$ 87
❑ Logitech Mouseman Serial PS/2 RH Item #75010-35		$ 67
❑ Microsoft Mouse-Bus Item #81453-35		$ 89
❑ Microsoft BallPoint Mouse w/Windows 3.1 Item #55034-35	F3	$ 149
❑ Logitech Scanman Model 256 Item #46485-53		$ 263
❑ The Complete PC Complete Page Scanner w/OCR Item #41725-53		$ 549

$189 Sound Blaster Pro

Monitors	
❑ NEC Multisync 3FGX Item #55195-23	$ 689
❑ NEC Multisync 4FG Item #75319-23	$ 799
❑ Radius PrecisionColor Display 19 Item #89497-23	$ 2,229
❑ Dell UltraScan 14C Item #320-3364	$ 449
❑ Dell UltraScan 15FS Item #320-3369	$ 549
Printers	
❑ IBM/Lexmark Personal Printer II 9Pin 80Col Item #99025-27	$ 349
❑ IBM/Lexmark Personal Printer II 24Pin 80Col Item #87025-27	$ 349
❑ Epson AP-3250 Item #330-1482	$ 205
❑ Canon BJ-10 Ink Jet Item #72069-28	$ 329
❑ IBM/Lexmark Color Jetprinter 4079 LJ Item #12993-28	$ 2,749
❑ IBM/Lexmark 4070 LJ Item #79832-28	$ 375
❑ Epson EPL-8000 Item #330-3347	$ 1,159
Printers Con't	
❑ IBM/Lexmark 4019 Laser Printer Item #79641-37	$ 849
❑ Genicom Model 7170 Item #12844-37	$ 3,215
❑ Okidata OL400P LED Page Printer Item #70695-37	$ 649
❑ Texas Instruments Microlaser Basic Item #13399-37	$ 899
❑ Texas Instruments Microlaser PS17 Item #12814-37	$ 1,215
Storage	
❑ Quantum Prodrive ELS 85MB IDE Item #03731-34	Int $ 215
❑ Quantum Prodrive ELS 127MB IDE Item #09734-34	Int $ 289
❑ Quantum Prodrive ELS 170MB IDE Item #16736-34	Int $ 325
❑ Conner Sof-Stor 3170 Item #76828-34	Int $ 565
❑ Colorado Jumbo 250 DJ-20 Item #88977-26	Int $ 269

Product	Media	Price
Storage Con't		
❑ Iomega Tape 250 Insider Halfheight Item #35848-34	Int	$ 249
Networking		
❑ Artisoft Lantastic Windows Utility 4.1 Item #20664-36	Dual	$ 179
❑ Artisoft Lantastic Starter Kit 4.1 Item #89634-36	Dual	$ 489
❑ Novell Netware Lite 1.1 Item #02829-36	F5	$ 59
❑ Novell Netware Lite 1.1 Item #01827-36	F3	$ 59
❑ Windows for Workgroups Item #13151-17	F5	$ 159
❑ Windows for Workgroups Item #13166-17	F3	$ 159
❑ SMC Ethercard +Elite 16 Combo Item #23477-36	Int	$ 198
❑ SMC Ethercard +Elite 16T Item #11544-36	Int	$ 145
❑ IBM Token Ring 16/4 Item #89733-36	Int	$ 549

CALL TODAY

Featured here is just a sampling of our thousands of products. To see more, call today for a free catalog.

NOW YOU CAN GET LOW U'VE ACTUALLY HEARD OF.

day for only five dollars.

Of course, we'll also solve any problems you may have installing the products you buy from us. And if you order software, we'll even enter your name on AppTrac™ (DellWare's application tracking program) and let you know ahead of time when new versions are coming out, so you can upgrade accordingly.

To order something from above (or to ask for a free catalog featuring the complete DellWare selection), simply phone toll-free. And forget about those other guys.

Whatever their name is.

DELL

800-241-5865

WHEN CALLING, PLEASE REFERENCE **#11BDK**
HOURS 7AM-9PM CT MON-FRI, 8AM-4PM CT
SAT, 10AM-3PM CT SUN

others. ©1993 Dell Computer Corporation. All rights reserved

How Routers Pass Information

With large networks connecting tens of thousands of devices, passing data between two stations is no longer a trivial task. No longer can all stations be placed on a single network; they must be separated onto multiple LANs. These LANs in turn must be connected by either a bridge or a router.

The simplest way to solve this problem is with a transparent bridge. In this strategy, each station contains a listing of all network devices. The bridge looks at the traffic, compares the destination address against an address table it contains, and then forwards the frame onto the adjoining LAN if necessary.

Although they are effective for connecting a few networks, bridges begin to falter in the enterprise network. A router takes a different approach. It distributes the address table among the routers to which it is connected. Each router knows the addresses of the nodes on one network, and it notifies adjoining routers that if a packet is destined for a particular network it should be forwarded to the corresponding router. So when a router needs to forward data from one station to a station on another network, it forwards the data to the appropriate router, which in turn directs the frame onto the receiving station. (In the case of DECnet and OSI, the process is slightly different. Routers exchange actual station addresses and not just network addresses.)

By looking at the network address, routers can gather additional information to help make the forwarding decision. For example, a router can identify the type of data that is being sent and exactly who is sending it. By analyzing that type of information, it can filter the data according to different criteria, such as which users have access to which types of connections and which protocols are given priority to move through the wide-area network of connected routers.

But the actual process of routing the data is far more complex than simply reading an address. It hinges on the ability of the router to accurately read the protocol data, which is packaged together with the addressing information in what's termed a *packet.*

Each packet starts with the hardware address of the device receiving the data (the destination address) and the address of the device sending the data (the source address). Subsequent information indicates the type of protocol the packet contains. Inclusion of this information allows multiple protocols to use the network simultaneously.

There are many protocols used in communications; some common examples are Novell NetWare's Internet Packet Exchange (IPX), Microsoft LAN Manager's NetBIOS, and the Internet Protocol (IP) component of TCP/IP. The format of the remainder of the packet depends on the type of protocol being used.

Routers use protocols to advertise their direct LAN connections and any connections they have learned about from neighboring routers.

Not all protocols are routable. Packets in a nonroutable protocol format don't differentiate between LANs; to those packets, all the world looks like one LAN. NetBIOS, for example, is an unroutable protocol. These protocols must be bridged, since no useful information is carried for routing.

But routable protocols contain information to differentiate between LANs. Most contain source and destination addresses that identify the LAN and the particular device connected to that LAN. (DECnet and OSI are two routable protocols that operate somewhat differently; their source and destination addresses contain an area, not a LAN address.) An area may span one or more LANs.

FORWARDING THE PACKET

Routers use this information to move packets between network interfaces, each of which is connected to a LAN. Unlike bridges, routers only receive packets addressed to the router's own hardware address. Thus, if a node on a LAN needs to send a packet to a node on another LAN, it must first know that the destination node is on another LAN, and it must also know the hardware address of the router associated with that LAN.

In sending a packet, the node first compares its own network number with the network number of the destination. If they are the same, the destination node is on the same LAN, and the packet needn't go onto the router network. If the network numbers are different, the node checks its own configuration to find the hardware address of the router to which the packet will be sent. The node could be preconfigured to always send packets to a specific router or it could be listening to the routers advertising themselves on the WAN to dynamically determine the best router.

When a router receives a packet, it examines the destination address to see if the packet is addressed to the router itself. This process, known as *address lookup,* is performed against a database (called the *address table),* which is in part gathered from the other routers on the network. Each address is associated with the port on the router to which the data should be sent and with the address of the router to which the packet should be directed.

Network management and routing packets contain the router's own proto-

col address or a protocol broadcast address indicating that all nodes should act as if the packet is directly addressed to them. If the packet is for the router, it is forwarded to the part of the router software to be processed.

If the packet does not contain the router's protocol address, the router must determine if it can be forwarded to the correct destination. There are three possibilities: The router could be directly connected to the destination LAN, the router could find the destination LAN in its routing table, or the destination could be unknown.

If the destination is on a directly attached LAN, the router goes through a protocol-specific process to find the hardware address of the destination node and then forwards the packet on the LAN to that node.

However, if the destination address is found in the routing table, the router will extract the protocol address of the next router (which will be on a directly connected LAN), find its hardware address, and forward the packet to the next router for further disposal.

The last case is specific to TCP/IP. Instead of discarding a packet destined for a node not directly connected to the same LAN and not in the routing table, the packet will be forwarded by default to a router that might have a fuller picture of the Internet and thus find a path to the destination LAN. If no default router is configured the packet is discarded and the station is notified.

BUILDING THE ADDRESS TABLE

How routers build their address tables is crucial to their functioning in large networks. *Routing protocols*, the message formats that routers use to exchange information, are defined by the respective vendors or organizations for every network protocol. Novell, for example, uses a form of the routing information protocol (RIP) for IPX. The body that administers IP defined five routing protocols for exchanging information between organizations: a different form of RIP, the Open Shortest Path First (OSPF), the Integrated Intermediate System to Intermediate System (Integrated IS-to-IS), the Exterior Gateway Protocol (EGP), and the Border Gateway Protocol (BGP).

Each router uses a routing protocol to advertise its own direct LAN connections and any connections that it has learned about from its neighboring routers. This information is sent by all routers to all adjacent routers every 10–90 seconds, depending on the particular protocol. Each network protocol normally needs a separate routing protocol, exchanging information separately for TCP/IP, IPX, and AppleTalk, for example.

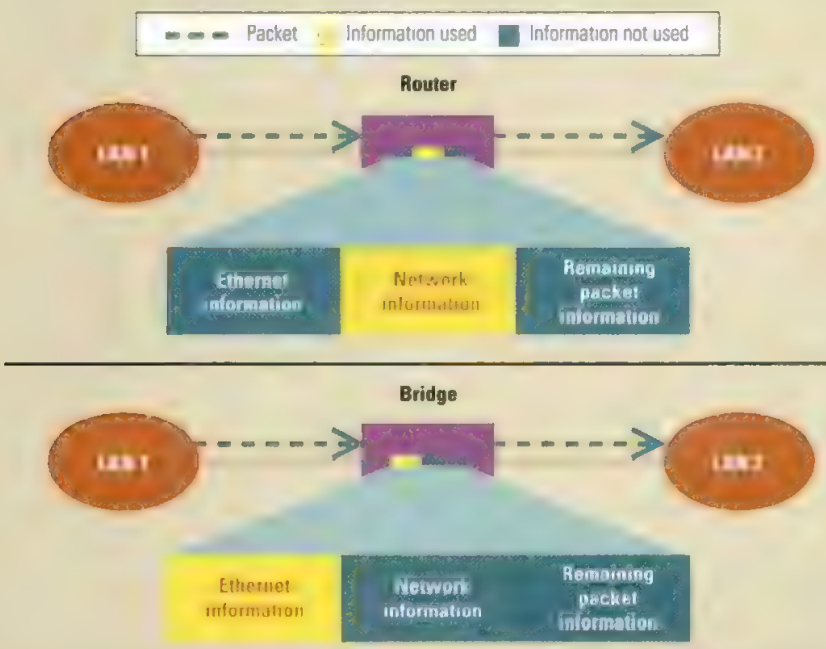
Aside from a list of the networks that the router knows about, each RIP advertisement includes a metric indicating the distance to the network using the best path available to the router.

Each router, on receiving an advertisement, compares the networks listed with those already entered into the routing table. If the advertisement includes one or more networks not in its own database, the new information is added and the router that was the source of the advertisement is listed as the next hop on the path to the network.

If the advertisement contains information about a network that is already in the routing table, but the metric value received is lower (that is, the path is better) than the existing value, the routing table entry is replaced. When it comes time for this router to send out an advertisement, it sends out the entire contents of its routing table, adding its own internal metric to the metric in the entry. In this way, each router running RIP maintains a full list of all LANs in the Internet and the next hop for the best (lowest-value metric) path to the LAN.

Each router in the path will make its own forwarding decisions for each of the packets that it receives. Because of the dynamic nature of the route advertisement process, there is no guarantee that all the packets from one node to another will follow the same path through the network. The routers will continue forwarding the packet until it reaches the destination node. □

Routers vs. Bridges



Routers and bridges both forward data between networks. But while routers make their decisions based on the network address, bridges forward frames based on the Ethernet station address.

mirror the organization of many businesses, in which a corporate headquarters acts as the hub for several remote research, sales, or service offices.

Network managers may connect the workgroups at the corporate headquarters via a backbone, in which case several small, or peripheral, routers sit in each workgroup. These might be the same routers that reside in a remote office and connect that office back to the main network through a leased or a circuit-switched line.

Not all protocols are routable. To packets in a nonroutable protocol format, all the world looks like one local area network.

Another approach is to tie the smaller routers into one central router, which acts as a "collapsed backbone." In this approach, the backplane of the router, rather than a separate Ethernet, FDDI, or Token-Ring network, connects the workgroups together. How many LANs a central router connects depends on the given configuration, but we anticipate the number to be at least eight. (For more information, see "Classifying Routers.")

Because central routers connect many networks together, they need to offer a large selection of LAN and WAN interfaces. Typically, Ethernet and Token-Ring are a must for LAN connections. WAN interfaces require at least T1 support with frame relay, High-level Data Link Control (HDLC), PPP, and X.25 as the WAN protocols.

Central routers tend to use a chassis design so that interfaces can be replaced. As more interfaces are added to the router, the need for enough processing power to support increased traffic becomes crucial. Without such power, a central router effective at handling two or three network streams won't be able to scale up to six or eight streams. The IBM 6611 Network Processor 140, a peripheral router with many central-router characteristics, was the only product that showed perfect scalability.

As you connect more networks, the chance that more network protocols will have to be routed becomes greater. So central routers especially need to support many network protocols. Though we used only IP and IPX as filters, robust central routers will offer AppleTalk, DECnet, and eventually OSI as well.

Fault tolerance is likely to become an increasingly hot topic in the router market. None of the routers reviewed here are optimized for fault-tolerance, however. Among other vendors of routers, Corel Systems Corp. and Wellfleet Communications claim that their products are fault-tolerant, but neither offered IPX support during the time of our testing.

Central routers tend to be the most expensive type of router around. Exact pricing depends on the product's configuration, but for the central routers reviewed here—Cisco's AGS+/4 and 3Com's NETBuilder II—$15,000 to $20,000 is a good starting price.

PERIPHERAL ROUTERS

Routers designed to support a small office or workgroup with two to four interconnected LANs have different performance and management requirements than do central routers.

With fewer connections to handle, peripheral routers are significantly less complex. Vendors don't require the same processing resources and sophisticated hardware design to provide a high performance level. But as with central routers, performance still needs to be top-notch. Although many peripheral routers connect remote LANs through low-speed WAN links, some peripheral routers need to connect workgroups to high-speed backbones, such as FDDI.

The simplicity of peripheral routers is perhaps their most important feature. Because network managers in remote offices are typically less experienced than their counterparts at corporate headquarters, peripheral routers must be easy to install, thoroughly documented, and backed by excellent customer support.

Like central routers, many peripheral routers use a chassis design. This often makes it difficult to classify the products. We classified the IBM 6611 Network Processor 140, for example, as a peripheral router because the configuration we tested lacked a sufficient number of networks. With the release of new network modules, however, the 6611 should scale up to a central router.

Some routers, like those from HP and Proteon, support only a fixed configuration. Manufacturers of fixed-configuration routers cut costs by integrating interfaces onto the motherboard, rather than onto separate modules.

Pricing will be lower, but your options will be more limited. If you run out of connections or need to connect a network that is not supported by the router, you'll be forced to purchase a whole new box. Purchasing a modular unit that can be upgraded later may be a wiser strategy. The peripheral routers we reviewed cost considerably less than central routers. As with central routers, prices will vary greatly, depending on the configuration.

SUFFICIENT PERFORMANCE

With either type of router, matching the performance of the product to the needs of your particular network makes for a cost-effective purchase. If your remote office needs to be connected to a central office with a 9,600-bps telephone line, a router that can pass 14,879 64-byte packets per second (PPS) without fail would be quite a bit of overkill (a 9,600-bps line can only support 19 64-byte PPS).

A properly designed network can help ensure that you'll be able get away with this less costly solution. Applications at a local site, for example, tend to be client-server oriented, where a significant amount of traffic occurs between a client and a file or application server. If a router separates the clients and their servers, the router will have to handle more traffic than if the clients and servers were located on the same network.

How many PPS a router will have to handle is also a function of the type of network being connected and the size of the packets being sent. On Ethernet, for example, a total of 812 PPS can be transmitted onto the LAN if all packets are the maximum size—1,518 bytes. If the packets are the minimum size—64 bytes—as many as 14,880 PPS can be transmitted. The actual limits can be

To Every LAN Manager Who Thought Remote Access Was Hard,

U.S. Robotics Just Made It Simple.

Introducing the Shared Access™ Communication Server 386™ and LAN modem.™ Easy, complete solutions from the company that invented "plug it in and forget about it."

For remote users, LAN-based users or both, our new Shared Access products provide complete desktop solutions that give all your users transparent remote access to Novell™ LANs.

Easy to install, each product includes an Ethernet NIC, an upgradable modem and all the software you need to dial in and dial out. Plus the Comm Server 386 has a dedicated 386 processor.

Easy to support, these are the only products with both remote control and remote node. Switch seamlessly between the two access technologies for unprecedented ease of use!

Today's only full family of products, Shared Access demystifies the remote access problem. And dollar-for-dollar, a Shared Access solution is more affordable.

So take the simple way out. Call **1-800-DIAL-USR.**

U.S. Robotics®

The Intelligent Choice in Data Communications

CIRCLE 231 ON READER SERVICE CARD

8100 N. McCormick Blvd., Skokie, Illinois, 60076-2999. Tel. 708-982-5010.

much lower, however, depending on the number of active hosts on the network. The more active hosts, the greater the contention for bandwidth and the lower the actual traffic rate.

The theoretical limits for Token-Ring and FDDI are less precise, because of the token-passing procedures these networks use. When handling the same frame sizes as Ethernet, 16Mb Token-Ring can move about 1,300 PPS for 1,518-byte packets and about 24,500 PPS for 64-byte packets. The maximum number of PPS for FDDI are about 8,100 for 1,518-byte and 160,000 for 64-byte packets.

Few applications can really use this kind of bandwidth, however. Certain graphics applications, such as CAD/CAM, do approach the limits of Ethernet and Token-Ring. But the vast majority of commercial applications pose little problem for today's networking standards.

But there is every reason to expect that a whole range of applications will raise the traffic level on networks and therefore the processing requirements of routers in the near future. So when you purchase a router, be sure it packs some extra power for the added packet load that tomorrow's applications will bring.

WHAT TO LOOK FOR

There are at least eight areas to consider when buying a router: proper configuration, manageability, security, performance, reliability, standards tracking, documentation, and vendor support.

Proper Configuration A router can be an asset to your company only if it is properly configured, and if that configuration is easy to do. The latter is crucial—in fact, two vendor representatives, from DEC (whose DECnis 600 Multiprotocol Router is reviewed in a sidebar) and Network Systems Corp. (NSC), actually mis-

Bon Voyage: *The DECnis 600*

by George Pornaras

It's as if Digital Equipment has given up on us Yanks. With the DECnis 600 Multiprotocol Router, Digital squarely addresses the needs and concerns of the OSI-oriented European market. At the same time, the company seems to be ignoring the needs and concerns of the U.S. corporate market, providing scarce support for the IP protocols that drive most of the country's corporate WANs. It's as if Digital were saying, "Vive l'Europe!" and "Yankee, go fish!" all in one breath. Bold trendsetting maneuver or marketing miscalculation? It might well be both.

As Europe has gone much farther along the ISO OSI standardization path than the U.S. has, it is only natural to suppose that Digital is targeting Europe for its latest router introduction, the DECnis. For starters, most of the router's development was accomplished in Great Britain, not in the United States.

And since this country presently harbors by far the largest TCP/IP-based network anywhere in the world, and since the DECnis has not even started to address those IP-IBM market concerns (manifested by its lack of SNMP, OSPF, Token-Ring, and SNA encapsulation products), it is evident that Digital is definitely not headed for dominance of U.S. corporate network routing any time soon. At least not with the DECnis.

So what is this cosmopolitan router good for? For starters, the DECnis has plenty of horsepower in store for its intended OSI user base. Its central processor is a VAX chip with up to 8MB RAM and 2MB flash electrically erasable programmable ROM (EEPROM). Each I/O card has up to four RISC processors with 256K of RAM, which allows plenty of room for CPU activity. There is an additional 11MB of memory, 3MB of which is used exclusively for the routing tables and their maintenance, and 8MB of which is used for shared memory.

The fan-out is also impressive. There are seven slots for line cards in the 600 model with the ability to hold a dual attached station (DAS), dual Ethernet, and dual serial T1 as well as eight-port, 128Kbps WAN cards. All this is encased in a box designed to withstand being dropped from a ten-story building. (The only damage would doubtless be done to the pavement.)

Then there are the protocols that make the router what it is: IP, IPX, AppleTalk II, DECnet, OSI CLNS/CMNS, Integrated IS-IS, ES-IS, RIP, PPP, X.25, X.21, and CMIP. With the product's focus on OSI, OSPF and SNMP are conspicuously absent, replaced by Integrated IS-IS, which handles both IP and IS-IS routing, and CMIP, which does all the network monitoring and management.

However, since there isn't a Telnet or FTP capability, the ability to log in and transfer files to the router is seriously hampered in the IP domain. (Other means exist for accomplishing those tasks in the OSI world.) Also, since there isn't an RS-232 console port on the DECnis, no out-of-band management capability exists.

Finally, there are the off-line configuration programs that are used for setting up the router. Somewhat similar in concept to the IBM's GUI configuration program, the Digital configuration programs are nonetheless text-oriented setup programs (unless one owns a DECmcc management console).

configured their routers during performance tests at Harvard.

The configuration of the router hinges on support for the right access method, the cabling, the network protocol, and the routing protocol. All of the routers reviewed here support Ethernet; some offer Token-Ring and FDDI support as well. These access methods can use a variety of cabling. Ethernet, for example, can run over fiber, thick-coax, thin-coax, and unshielded twisted-pair (UTP) wiring. Token-Ring will run over fiber, shielded twisted-pair (STP), and UTP.

As for network protocols, Novell's Internet Packet Exchange (IPX) and the Internet Protocol (IP) are common across all the products we reviewed. NetBIOS, commonly used in peer-to-peer LANs, must be bridged. Most of the vendors offer transparent bridging, except for Novell. IBM supports only source-route bridging.

IBM's System Network Architecture (SNA) is another protocol that is gaining widespread support. SNA is the network architecture that IBM uses for connecting its mainframes. Traditionally, SNA networks existed separately from LANs. This meant that companies typically had to maintain separate wide-area links for SNA as well as LAN-based networks: an expensive proposition at best.

With SNA support, routers can pass SNA traffic over the LAN. There are two general approaches to this. The best approach, used by IBM and Cisco, is what IBM calls Data Link Switching (DLS), also known as "poll-spoofing." This approach terminates the SNA connection at the router. The host polls the router, not the terminal, for data. The router in turn sends the terminal's data to the host. This prevents excess SNA traffic from crossing the link, so network managers can place terminals farther away from the IBM hosts.

Many other vendors use SNA encapsulation to forward SNA traffic across the LAN link. The SNA data is encapsulated in a TCP/IP frame and routed across the network. This approach is cheaper and easier to implement, but it adds network traffic and does not extend the distance between terminals and IBM hosts.

Two routing protocols are widely supported by the products: OSPF and RIP. Both allow routers to share routing information with each other. RIP is fine for small to medium-size networks, and OSPF is quickly becoming the choice as the enterprise-wide solution.

Since routers are so complex, we recommend looking for a product that offers off-line configuration. With this procedure, you configure the router without attaching it to the network, so you avoid accidentally impacting your network. Among the vendors whose products we reviewed, IBM was the only one to offer off-line configuration, but we expect to see this function more widely available and touted in the future.

Manageability Routers can be managed either through SNMP or directly through a terminal connection. When management is handled through a terminal connection, good on-line help is especially important. The vendor should ideally provide a clear explanation, accessible at the terminal, of the various options for proficient and effective management.

SNMP allows you to gather bits of information from devices across the network. With SNMP, you'll want strong

Further, configurations are *always* created and compiled off-line using CMIP (on a VAXStation running VMS or from an Ultrix host) before they are downloaded to the target router. No reasonably simple option exists for on-line configuration of the DECnis.

The download host also maintains a database of configurations for multiple DECnis units. As with the IBM unit, the DECnis comes with copious amounts of documentation, tutorial information, and excellent technical support.

OSI support is indeed more prevalent in Europe than in the United States, but there's certainly one large potential customer base here in the States. Given the hardware and software makeup of a typical DECnis along with its sturdy construction and centralized support capability, it isn't hard to visualize this router working for the U.S. government.

The government's heavy emphasis on OSI product selection and the mandatory use of OSI by all federal agencies ensures eventual acceptance of the DECnis by the government sector. Digital may be positioning itself to reap the fallout of federal OSI-procurement compliance laws (for example, GOSIP) and take advantage of federal agencies' predisposition to selecting large, stable, and reliable vendors to fill those OSI procurement orders. If so, then the DECnis is definitely right on the mark.

On the other hand, Digital may have overestimated the size, scope, timing, and demand for OSI products and underestimated these critical marketing factors for IP networking products. They may, in fact, have preempted the market by rolling out the DECnis now. Perhaps Digital determined that demand would be high in the commercial sector for its DECnet IV follow-on product. This could have led the company to invest heavily in OSI, as that international standard represents the only viable growth path other than IP for the DECnet protocol stack. Perhaps Digital incorrectly read the signs on the networking horizon that spelled out "IP" in hazy RFC (Request for Comment) standards-discussion numbers numbers. That too would have meant less development in the IP domain and more in the ISO.

In either case, the effect is the same: Digital's future, at least in multiprotocol networking, is now inextricably tied to the OSI world and is woefully limited in the IP arena. If OSI succeeds, the DECnis 600 MPR will be the perfect router for the job at hand. But at least for now, or until OSI penetrates the U.S. market, it looks like a long European vacation for the DECnis 600 MPR. □

► **FACT FILE**

DECnis 600 Multiprotocol Router
Digital Equipment Corp., 146 Main St., Maynard, MA 01754-2571; 800-332-4636, 508-493-7161.
List Price: *$11,600 (platform), Ethernet card, $2,400; WAN card, $4,000.*
Requirements: *None.*
Circle 499 on reader service card

Performance Tests: Routers

What the Numbers Mean

In our tests, all of the routers were able to forward the traffic generated by a single LAN. The amount of WAN traffic the routers can pass is limited only by the link speed. The Cisco AGS+/4 had the best performance among central routers; three products stood out favorably among peripheral routers.

Routers are categorized as central or peripheral. A central router acts as a backbone for the network, connecting many LANs together. Peripheral routers connect individual LANs either to a central router or to each other.

Both types of routers were able to handle the amount of traffic typically generated on a network of more than a dozen nodes. This load will usually contain packets of various sizes; larger packets carry most of the data but move more slowly through the network than smaller packets. Smaller packet sizes place a heavier stress on the router by giving it more packets to forward.

CENTRAL ROUTERS

Only two of the tested routers are central routers: the Cisco AGS+/4 and 3Com Corp.'s NETBuilder II. The IBM 6611 Network Processor 140 would be a central router if configured with the company's dual-line WAN modules. These modules were not available during our testing, so we classified the 6611 as a peripheral router.

Both the Cisco device and the NETBuilder II offer top-notch performance and exceed the requirements of almost any conceivable Ethernet, FDDI, or Token-Ring network running TCP/IP. The Cisco AGS+/4 offers more ports than the NETBuilder, but its WAN performance with other protocols is a bit lower than with IP, since the Cisco device typically runs new protocols on a slower Motorola 68040 and not on its faster CiscoBus controller.

If you need a central router, you might consider three products included in Harvard Labs' tests but not reviewed here because of their lack of IPX support. The Alantec PowerHub, the DECnis 600 MPR (for more information on this product, see "Bon Voyage"), and the Wellfleet Backbone Node were excellent when handling six Ethernet streams (12 networks). All were able to forward more than 80,000 PPS (packets per second) for TCP/IP routing or bridging (the theoretical maximum number for these 64-byte packets was 89,280 packets). Each device was within a few percentage points of the theoretical limit for six full Ethernet data streams when the network was saturated with 1,518-byte packets (3,248 packets).

PERIPHERAL ROUTERS

Peripheral routers serve fewer networks than central routers. Clearpoint's Constellation Pixis (and its twin, the Datability DXA 550), the NSC 6607 Bridge-Router, and Xyplex's Network 9000 Intra-Networking Hub all displayed excellent performance. All were able to handle more than 90 percent of Ethernet's theoretical maximum with 64-byte packets and more than 98 percent of full theoretical Ethernet capacity with 1,518-byte packets. The HP Router ER is slightly slower than this group but will perform adequately on almost all existing Ethernet networks. The Novell router performed well, but it is geared mainly to NetWare-centric networks.

Advanced Computer Communications' ACS 4200 was a bit slower than the rest of the routers, but it can handle most network loads. Problems may arise, however, when the router is used to connect clients and servers that communicate frequently. In this situation, many small frames are passed between the nodes—frames that are particularly difficult for any router to handle, and especially the ACS 4200.

On the Ethernet-to-Ethernet LAN testing, the Proteon ProNet DNX-300m was the slowest router, with a forwarding rate of about 4,000 64-byte PPS for bridging and for IP routing, and even fewer for IPX routing. But this router would still be able to handle the full load of most networks.

The IBM 6611 Network Processor 140 nearly fits into the central router category. With the new interfaces that are now available, the 6611 can connect enough WANs to function as a central router. It offers impressive Ethernet and Token-Ring performance when handling large frames, but it is slow with small packets. We attribute this to poor protocol programming. The IBM device's architecture should be able to support a much higher packet rate, and future versions of the IBM software will significantly raise the throughput.

The IBM's perfect scalability is unique. Each interface card on the IBM router has a separate RISC processor that performs all of the routing functions and transfers packets directly to the RISC processor of another interface card without going through a common controller. By increasing the number of interface cards, you increase the 6611's performance nearly proportionally.

How We Tested

Four configurations were used for testing these routers. The performance tests, run at Harvard University, were based on the work done by the Internet Engineering Task Force's Benchmarking Methodology Working Group. (Slightly different configurations were reviewed at ZD Labs.)

Three tests determined these products' throughput, packet loss rates, and latencies. We report only the Throughput test scores. The Packet Loss Rate test results are used as a basis for extrapolating throughput results in cases where the Throughput test could not be run. Significant Latency test results are noted in the reviews.

All the tests measured router performance when packets were sent in one direction through the test router. Bidirectional results are not reported here because of the difficulty of isolating the impact of the tester on performance, especially on an Ethernet network. We ran the local Ethernet

tests several times with varying numbers of active connections (or streams).

The Throughput and Packet Loss Rate tests were run on four network configurations. Two of them tested local Ethernet and Token-Ring performance, and two of them tested Ethernet and Token-Ring remote performance across 1.536-Mbps and 56-Kbps lines (as shown in four diagrams).

The vendors configured the routers for all supported protocols at the start of the tests, and the routers were not reconfigured until the test series was complete. This procedure simulates a real-world multiprotocol network. In some cases, this procedure probably reduced performance, particularly for routers with bridge mode enabled. A router that routes some protocols and bridges others requires more overhead, because it must deal with all the packets on a LAN rather than only those addressed to the router.

A range of packet sizes were used for each test. Packet sizes ranged from 64 bytes to 3,960 bytes, depending on the protocol being run and the type of network. Under AppleTalk, for example, protocol specifications relegated the packet size to a maximum of 512 bytes. Tests run on Ethernet used packet sizes up to the maximum 1,518 bytes; tests run on FDDI and Token-Ring used the maximum 3,960 bytes per packet.

Test limitations required that identically sized packets of the same protocol be used. Mixed-protocol results were inconclusive. Tests will be performed this summer to clarify the effects of mixed protocols on given routers.

The **Throughput** test is the best single indicator, from the end user's perspective, of how a router performs. The test identifies the fastest rate at which a router can process and forward incoming packets without error. The test sends a 30-second packet burst to the router. The tester than compares the number of packets forwarded by the router in each burst against the number of packets offered by the tester. If the router forwards all of the packets, the tester increases the number of packets sent and repeats the test. The testing continues until a packet is dropped or the maximum theoretical limit of packets is reached. This maximum limit varies. With a 56-Kbps link, a router can theoretically forward 108 64-byte Ethernet packets or five 1,518-byte Ethernet packets. On a 1.536-Mbps link, any router can forward 2,976 64-byte frames or 162 1,518-byte frames.

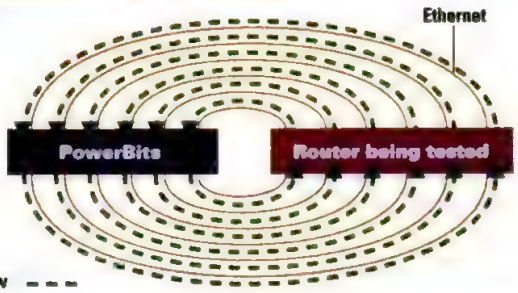
On a 56-Kbps WAN link, 110 64-byte Token-Ring packets or three 2,048-byte Token-Ring packets can be passed. On a 1.536-Mbps link, 3,123 64-byte packets or 99 2,048-byte packets can be sent. Results are measured in terms of the total number of packets per second forwarded.

The **Packet Loss Rate** test identifies how the router behaves when there are too many packets on the network. A 30-second burst of packets is sent to the router. The packet burst is either the network's maximum theoretical rate or the maximum rate that the tester can produce. The number of packets forwarded is then subtracted from the number of packets sent to determine the total number of lost packets. The tester repeats the test nine times, decreasing the load by 10 percent each time for each packet size. The results are expressed in terms of the percentage of packets dropped.

The **Latency** test measures the amount of delay the router imposes when forwarding a packet between two networks. A 100-PPS burst is sent through a router. The burst consists of about 5 seconds of data packets, followed by a specially marked packet and another 5 seconds of traffic. The tester records the time at which it transmits and receives the marked packet. The transmission time is subtracted from the reception time. Then the time the packet takes to travel on the cable (determined by the W&G DA30 testing device) is subtracted, yielding the amount of delay. The test is repeated ten times with various packet sizes, and the average result is calculated.

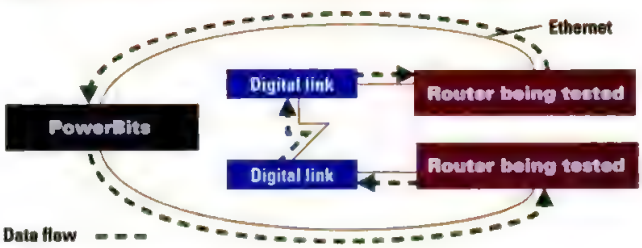
Harvard Labs used four configurations to test router performance.

A Ethernet to Ethernet



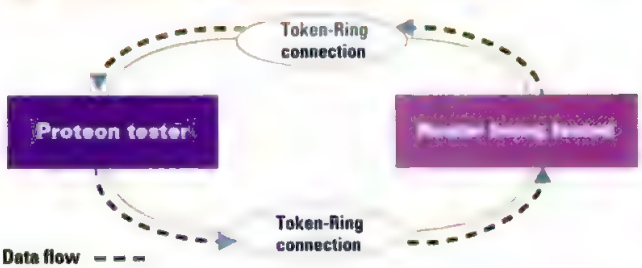
On this version of the Throughput test, Harvard Labs connected each router to an Alantec PowerBits traffic generator via 12 connections.

B Ethernet-to-Ethernet via WAN



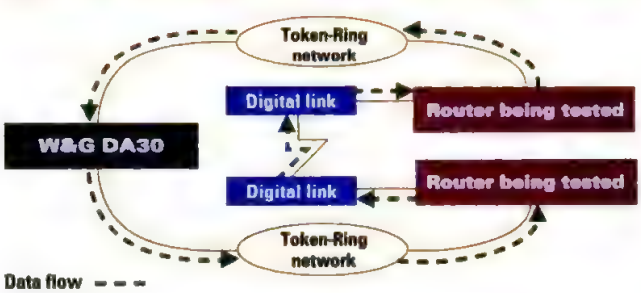
Each product's Ethernet WAN capability was tested by connecting two of each device through digital links as the WAN connection, and then again through a single Ethernet link as the LAN connection.

C Token-Ring to Token-Ring



Harvard Labs tested the local Token-Ring capabilities of each product by connecting each router via two links to a custom-designed Proteon tester.

D Token-Ring to Token-Ring via WAN



Token-Ring WAN performance was tested by connecting two of the same products via WAN digital links and via a W&G DA30 tester on a LAN.

Finely-Tuned Orchestrated Solutions...

It takes more than just great computers to meet the information management needs of today's businesses. It takes talented people who have the ability to orchestrate solutions using the finest products and services available. And that's precisely what you get when you choose Northgate.

Here are just a few examples of the hardware platforms that await you. Keep in mind that we'll configure your systems any way you like. And back them with service and support that was just named "Readers' Choice" by *PC Magazine*. Take a look, then call Northgate today.

Northgate® ZXPortable™
- 80486SX/25MHz or DX/25MHz processor
- 120MB hard drive (200MB available)
- 4MB RAM (expands to 16MB)
- VGA monochrome with 64 shades of gray or Active Matrix Color display with 256 simultaneous colors
- 86-key full-travel keyboard
- Nickel metal-hydride battery for up to 4 hours of power (3 hours color)
- 8.5" x 11" size
- Monochrome weighs 6.2 lbs.; color 6.4 lbs.
- MS-DOS 5.0 and Windows™ 3.1
- Trackball mouse
- Carrying case
- Free $395 value PackRat PIM/contact management software

ZXPortable 486SX/25
Monochrome **$1999** Color **$3799**

ZXPortable 486DX/25
Monochrome **$2199** Color **$3999**

Optional Docking Station $599

Docking Station Bundle with 14" SVGA color monitor, *OmniKey* keyboard, 1.2MB floppy drive and desktop mouse **$999**

Northgate 486-VL
- 80486SX/25 processor
- Upgradable to OverDrive™ processors
- Two bus-master VESA local bus slots
- Local bus video with 1MB RAM
- 128K cache
- 4MB RAM (expands to 64MB)
- 100MB hard drive
- Space-saving case (tower available)
- 1.2MB or 1.44MB floppy drive
- 14" SVGA color monitor
- 101-S keyboard

$1699 (Lease as low as $62.86/mo.)*

As configured above with 80486DX/33 processor **$1949**
(Lease as low as $72.11/mo.)*

As configured above with 80486DX2/66 processor **$2449**
(Lease as low as $90.61/mo.)*

SlimLine® 486 ZXP-L
- 80486SX/25 processor
- Upgradable to i486™ processors and OverDrives
- 1MB local bus video
- Virtual cache
- 4MB RAM (expands to 128MB)
- 100MB hard drive
- Space-saving SlimLine case
- 1.2MB or 1.44MB floppy drive
- 14" SVGA color monitor
- 101-S keyboard

$1499 (Lease as low as $55.46/mo.)*

Configured as shown with 80486DX/33 processor **$1799** (Lease as low as $66.56/mo.)*

Configured as shown with 80486DX2/66 processor **$2299**
(Lease as low as $85.06/mo.)*

Elegance 486 ZXP EISA
- 80486DX/33 processor
- Upgradable to other i486 processors and OverDrives; supports OverDrive based on Pentium architecture
- Six EISA expansion slots
- 128K cache (256K available)
- 8MB RAM (expands to 128MB)
- 240MB IDE hard drive
- Tower case
- 1.2MB or 1.44MB floppy drive
- Accelerated™ Windows video with 1MB RAM
- 14" SVGA color monitor
- 101-S keyboard

$2949 (Lease as low as $100.86/mo.)*

As configured above with 80486DX/50 processor **$3249** (Lease as low as $111.12/mo.)*

As configured above with 80486DX2/66 processor **$3449**
(Lease as low as $117.96/mo.)*

Elegance 486 ZXP
- 80486SX/25 processor
- Upgradable to i486 processors and OverDrives
- 64K cache
- 4MB RAM (expands to 32MB)
- 100MB hard drive
- Space-saving case (tower available)
- 1.2MB or 1.44MB floppy drive
- 14" SVGA color monitor
- 101-S keyboard

$1599 (Lease as low as $59.16/mo.)*

As configured above with 80486DX/33 processor **$1899**
(Lease as low as $70.26/mo.)*

As configured above with 80486DX2/66 processor and Tower case **$2399** (Lease as low as $88.76/mo.)*

At Prices That Will Make You Applaud.

Northgate OmniLAN Systems

Northgate offers a variety of "plug and play" network solutions for up to hundreds of users. Here is just *one* example.

Option #1: Novell® Server

- Elegance™ ZXP 486DX/50 EISA
- 16MB RAM
- Adaptec 1740 SCSI controller
- 525MB hard drive
- 1.44MB floppy drive
- Intel Ethernet Express 32-bit Thinnet interface card
- VGA video adapter
- 14" VGA monochrome monitor
- 101-S keyboard
- FREE installation of Novell NetWare with NetWare purchase

$4999 (Lease as low as $165.97/mo.)*

Advanced Application Workstation

- Elegance ZXP 486DX2/66
- 8MB RAM
- 240MB IDE hard drive
- 1.44MB and 1.2MB floppy drives Accelerated Windows video with 1MB RAM
- Intel Ethernet Express 16-bit Thinnet card
- 14" SVGA color monitor
- 101-S keyboard

$2999 (Lease as low as $102.57/mo.)*

Option #2: Windows for Workgroups System

- Elegance ZXP 486DX/33
- 8MB RAM
- 340MB IDE hard drive 1.44MB and 1.2MB floppy drives
- Intel Ethernet Express 16-bit Thinnet interface card
- Accelerated Windows video with 1MB RAM
- 14" SVGA color monitor
- 101-S keyboard and mouse
- MS-DOS 5.0
- Microsoft Windows for Workgroups installed

$2949 (Lease as low as $100.86/mo.)*

Power Workstation

- SlimLine ZXP 486SX/25
- 4MB RAM
- 240MB hard drive
- 1.44MB and 1.2MB floppy drives
- Local bus VGA with 1MB RAM
- Intel Ethernet Express 16-bit Thinnet card
- 14" SVGA color monitor
- 101-S keyboard

$1899 (Lease as low as $70.26/mo.)*

Special Pricing on Genuine Northgate *OmniKey*™ Keyboards

- Choose 101N1 with 12 F-keys on top; 102 with 12 F-keys on left or ULTRA with 12 F-keys on top and left
- Alps™ click/tactile key switches
- Independent inverted "T" cursor control and numeric keypads
- Limited dexterity features
- Rate select from 3-120 CPS
- Interchangeable CRTL, ALT, CAPS LOCK keys
- *OmniKey* utility disk
- Unmatched IBM® compatibility
- FCC Class B certified

OmniKey/101N1 or 102 **Was $89**
NOW $79
OmniKey/ULTRA-T **Was $129**
NOW $99

Call For More Information
800-453-0162

GSA #GS00K91AGS5193 PS01

Major credit cards, money orders, direct wire and approved company purchase orders accepted.

SERVICE · RELIABILITY · PC MAGAZINE · READERS' CHOICE

intel inside

NORTHGATE

Solutions for Workgroups

7075 Flying Cloud Drive, Eden Prairie, MN 55344

©Copyright Northgate Computer Systems, Inc. 1993. All rights reserved. Northgate, Omniview, Elegance, SlimLine and the Northgate N logo are U.S. trademarks or registered U.S. trademarks of Northgate Computer Systems. Intel and the Intel Inside logo are trademarks of Intel Corporation. All other products and brand names are U.S. trademarks and registered U.S. trademarks of their respective companies. Prices and specifications subject to change without notice. Prices shown are U.S. dollars and do not include shipping and handling charges or appropriate sales taxes. Northgate reserves the right to substitute components of equal or greater quality or performance. All terms subject to availability.

Performance Tests: Routers

ETHERNET-TO-ETHERNET THROUGHPUT

64-byte packets

1 stream 4 streams* 6 streams

Packets per second (PPS)

	1 stream	4 streams*	6 streams
Central routers			
Cisco AGS+/4 (Bridge	13,986	25,594	24,877
Cisco AGS+/4 (DECnet,	14,266	20,237	*17,856
[illegible]	14,268	52,377	79,507
Cisco AGS+/4 (IPX)	14,268	20,930	*20,863
[illegible]	2,312	2,321	2,410
3Com NETBuilder II (Bridge	14,725	47,139	N/A (1)
3Com NETBuilder II (DECnet)	14,746	34,997	N/A (1)
3Com NETBuilder II (IP	14,744	46,187	N/A (1)
3Com NETBuilder II (IPX	14,748	33,926	N/A (1)
3Com NETBuilder II (OSI	14,752	17,141	N/A (1)
Peripheral routers			
[illegible]	4,983		N/A (1)
[illegible]	4,735		N/A (1)
[illegible]	N/A (1)		N/A (1)
[illegible] Ports	14,879		N/A (1)
[illegible]	14,332		10,423
[illegible]	N/A (1)		
[illegible]	7,732		5,429
HP Router ER (DECnet	7,010		4,620
HP Router ER (IP	N/A (1)		N/A (1)
HP Router ER (IPX	N/A (1)		3,462
IBM 6611 Network Processor 140 (DECnet)	4,464		3,904
IBM 6611 Network Processor 140 (IP	N/A (1)		13,917
IBM 6611 Network Processor 140 (IPX	6,679		13,922
IBM 6611 Network Processor 140 (OSI	6,396		N/A (1)
[illegible]	N/A (1)		N/A (1)
[illegible]	9,062		9,905
[illegible]	N/A (1)		3,995
Proteon DNX 300m (DECnet	N/A (1)		3,976
Proteon DNX 300m (IP	1,930		N/A (1)
[illegible]	14,479		14,778
[illegible]	12,798		9,765
[illegible]	N/A (1)		
Xyplex Network 9000 Intra [illegible]			
[illegible] Hub (OSI)			

WORST BEST

1,518-byte packets

1 stream 4 streams* 6 streams

Packets per second (PPS)

	1 stream	4 streams*	6 streams
Central routers			
Cisco AGS+/4 (Bridge	811	3,238	4,857
[illegible]	811	3,238	*4,862
[illegible]	811	3,238	4,856
[illegible]	811	3,248	*4,872
[illegible]	473	1,518	*1,518
[illegible] (Bridge)	811	3,248	N/A (1)
[illegible]	811	3,248	N/A (1)
3Com NETBuilder II (IP	811	3,248	N/A (1)
3Com [illegible]	811	3,248	N/A (1)
[illegible]	811	3,248	N/A (1)
Peripheral routers			
[illegible]	807		N/A (1)
[illegible]	N/A (1)		809
[illegible]	N/A (1)		N/A (1)
[illegible]	811		N/A (1)
[illegible] Ports (IP	811		Clearpoint Constellation P[illegible]
811			Clearpoint Lon[illegible]
N/A (1)			800
799			799
810			N/A (1)
N/A (1)			809
810			811
810			811
N/A (1)			N/A (1)
N/A (1)			711
727			N/A (1)
802			N/A (1)
804			790
N/A (1)			805
805			805
[illegible] Hub (IPX	811		[illegible] a Networking Hub (OSI	N/A (1)

WORST BEST

* These throughput scores were calculated based on Packet Loss Rate test results N/A (1)—Not applicable. The vendor did not configure the router for testing with this protocol

ETHERNET-TO-ETHERNET THROUGHPUT VIA WAN

64-byte packets

56-Kbps connection 1.536-Mbps connection

Packets per second (PPS)

	0	1,000	2,000		
Central routers					
Cisco AGS+ 4 (Bridge)				95	2417
Cisco AGS+ 4 (IP)				107	2975
Peripheral routers					
Clearpoint Pixis** (Bridge)				97	N/A (1)
Clearpoint Pixis** (IP)				N/A (1)	N/A (1)
HP Router ER (Bridge)				92	2,645
HP Router ER (IP)				107	2,975
IBM 6611 Network Processor 140 (Bridge)				N/A (1)	N/A (1)
IBM 6611 Network Processor 140 (IP)				107	2,975
NSC 6607 Bridge Router (Bridge)				83	2,448
NSC 6607 Bridge Router (IP)				107	2,975
Proteon DNX 300m (Bridge)				90	1,797
Proteon DNX 300m (IP)				107	2,301
Xyplex Network 9000 Intra-Networking Hub (Bridge)				99	2,571
Xyplex Network 9000 Intra-Networking Hub (IP)				107	2,974

WORST BEST

1,518-byte packets

56-Kbps connection 1.536-Mbps connection

Packets per second (PPS)

	0	40	80		
Central routers					
Cisco AGS+/4 (Bridge)				4	105
Cisco AGS+ 4 (IP)				4	106
Peripheral routers					
Clearpoint Pixis** (Bridge)				4	N/A (1)
Clearpoint Pixis** (IP)				N/A (1)	N/A (1)
HP Router ER (Bridge)				4	105
HP Router ER (IP)				4	106
IBM 6611 Network Processor 140 (Bridge)				N/A (1)	N/A (1)
IBM 6611 Network Processor 140 (IP)				3	106
NSC 6607 Bridge Router (Bridge)				N/A (2)	N/A (2)
NSC 6607 Bridge Router (IP)				4	106
Proteon DNX 300m (Bridge)				4	103
Proteon DNX-300m (IP)				4	106
Xyplex Network 9000 Intra-Networking Hub (Bridge)				4	105
Xyplex Network 9000 Intra-Networking Hub (IP)				4	102

WORST BEST

TOKEN-RING TO TOKEN-RING THROUGHPUT

64-byte packets

Packets per second (PPS)

Central routers	
	14,625
	14,625
	14,625
Peripheral routers	
	2,313
	3,274
	2,603
	3,733
	2,951
	3,364
	11,433
	12,638
	N/A (1)
	4,458
	1,510
	4,459

WORST BEST

2,048-byte packets

Packets per second (PPS)

Central routers	
	943
	943
	943
Peripheral routers	
	747
	N/A (3)
	743
	943
	N/A (3)
	943
	943
	943
	N/A (1)
	943
	405
	943

WORST BEST

TOKEN-RING TO TOKEN-RING THROUGHPUT VIA WAN

64-byte packets

56-Kbps connection 1.536-Mbps connection

Packets per second (PPS)

	0	1,000	2,000	3,000		
Central routers						
Cisco AGS+/4 (IP)					110	3,123
Cisco AGS+/4 (IPX)					110	2,603
Cisco AGS+/4 (SRB)					87	2,231
Peripheral routers						
ACC ACS 4200 (IP)					110	2,603
ACC ACS 4200 (IPX)					110	2,603
ACC ACS 4200 (SRB)					102	2,603
IBM 6611 Network Processor 140 (IP)					110	3,123
IBM 6611 Network Processor 140 (IPX)					N/A (1)	N/A (1)
IBM 6611 Network Processor 140 (SRB)					91	2,603
Novell MultiProtocol Router (IP)					N/A (1)	N/A (1)
Novell MultiProtocol Router (IPX)					N/A (1)	1,612
Novell MultiProtocol Router (SRB)					N/A (1)	N/A (1)
Proteon DNX 300m (IP)					110	2,230
Proteon DNX 300m (IPX)					110	1,861
Proteon DNX 300m (SRB)					110	1,870

WORST BEST

2,048-byte packets

56-Kbps connection 1.536-Mbps connection

Packets per second (PPS)

	0	30	60	90		
Central routers						
Cisco AGS+ 4 (IP)					3	90
Cisco AGS+/4 (IPX)					3	90
Cisco AGS+/4 (SRB)					3	90
Peripheral routers						
ACC ACS 4200 (IP)					3	9
ACC ACS 4200 (IPX)					N/A (3)	N/A (3)
ACC ACS 4200 (SRB)					3	90
IBM 6611 Network Processor 140 (IP)					3	90
IBM 6611 Network Processor 140 (IPX)					N/A (1)	N/A (1)
IBM 6611 Network Processor 140 (SRB)					3	90
Novell MultiProtocol Router (IP)					N/A (1)	N/A (1)
Novell MultiProtocol Router (IPX)					N/A (1)	120
Novell MultiProtocol Router (SRB)					N/A (1)	N/A (1)
Proteon DNX 300m (IP)					3	90
Proteon DNX 300m (IPX)					3	90
Proteon DNX 300m (SRB)					3	90

WORST BEST

** These test results are based on the Datability DXA550, a repackaged version of the Constellation Pixis

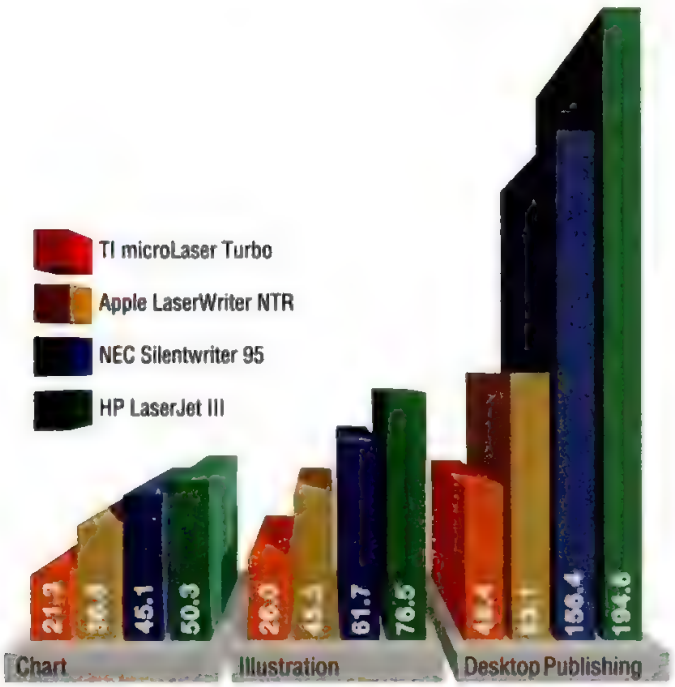
N/A (1)—Not applicable. The vendor did not configure the router for testing with this protocol. N/A (2)—Not applicable. This test could not be run because the vendor misconfigured the router.

N/A (3)—Not applicable. This router could not handle 2,048-byte IPX packets.

FASTER FASTER FASTER

AVAILABLE IN SPECIALLY MARKED TI POSTSCRIPT PRINTER BOXES. OFFER ENDS MARCH 31, 1993.

LOWER



Total Printing Time In Seconds

It's a fact. Now you can get faster PostScript® printing at a new lower price.

According to benchmark performance tests,* the TI microLaser™ Turbo printer is faster than the Hewlett Packard LaserJet® III, NEC 95 and Apple® NTR when it comes to charts, illustrations and desktop publishing. That's because it sports *two* processors – standard and RISC – for turbo-charged speed.

But when it comes to high performance, consider what else the Turbo has to offer:

POSTSCRIPT Software from Adobe

Your choice of PC or PC/Macintosh® configuration. HP LaserJet II emulation and Adobe® PostScript Level 2 software with 35 of the most popular outline fonts to dress up your documents. Automatic switching between HP and PostScript modes so you can print and go – no set-up, no problem. And the ability to connect simultaneously to more than one computer, Windows™-based or Mac, and print with ease.

Best of all, with its new lower price of $1,749** for the PC model and only $50 more for PC *and* Mac compatibility, the microLaser Turbo is selling fast, too. Call right now for more information on the Turbo or other microLaser printer models. **1-800-527-3500.**

TEXAS INSTRUMENTS

MACWORLD MW MacUser

*Call TI for a copy of Genoa Technology's benchmark test results and specifications of models tested.
**Manufacturer's suggested retail price – dealer prices may vary.
microLaser is a trademark of Texas Instruments Incorporated. Adobe, PostScript and the PostScript Logo are trademarks of Adobe Systems, Incorporated, which may be registered in certain jurisdictions. Apple and Macintosh are registered trademarks of Apple Computer, Inc. Windows is a trademark of Microsoft Corporation. The microLaser printer family has earned MacWorld's 1992 Editor's Choice Award and the microLaser Turbo has earned MacUser's 1992 Four Mice award. Reprinted from MacUser, September 1992. ©1992 Ziff Communications Company.

©1992 TI

CIRCLE 304 ON READER SERVICE CARD

76532

support for MIB II and you'll want to shy away from proprietary MIBs wherever possible. SNMP is in a state of evolution. The new version, called SNMP II, makes a number of significant changes to the protocol. One change involves adding security features to prevent an unauthorized user from reconfiguring the router. Be sure that the vendor you choose plans on supporting the protocol and can tell you how it will be supported.

Though a number of new routers will be entirely configurable with SNMP, you'll still want to be able to connect a terminal to the router. Terminal connections allow you to gather information from devices connected to the network or, in the case of a cable break, through a remote connection via a modem or serial cable. In either case, it's commonly called an out-of-band connection.

A number of vendors are trying to make it even easier for a centrally located network manager to manage remote routers. Cisco, for example , allows the network manager to dial into the router and remotely update software on the router itself. (3Com is developing a similar technique for the NETBuilder line of routers.) 3Com has just announced its border gateway protocol, which allows a remote router to inherit its configuration from a central router.

Be sure that the terminal screens are easy to read. Ask the vendor for a hands-on test of the user interface. Though we've looked at and rated the interfaces in these reviews below, our observations are necessarily subjective.

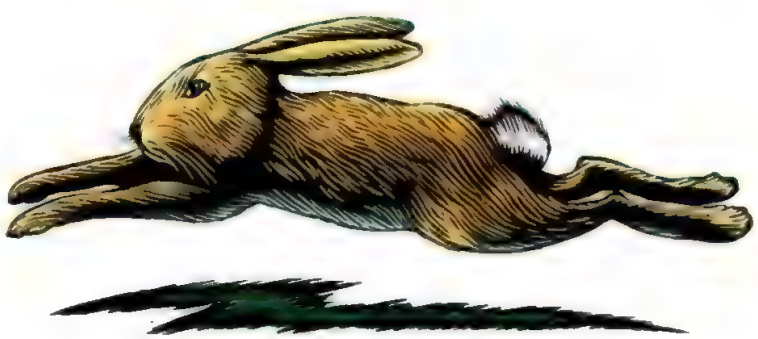
Security Preventing some types of data from entering the network is critical to ensuring network integrity. All networks connected to the Internet, for example, should be able to implement the filters recommended by the Computer Emergency Response Team (CERT). These recommendations stipulate that the router should be able to selectively reject packets that do not conform to the list of permitted protocols. In many environments, the same type of filters (also known as access lists) are used to protect against network managers who might misconfigure local network devices. The router should be able to implement the filters that are necessary for reliable and secure network operation. The manager should be able to disable the SNMP SET commands to prevent unauthorized interaction.

Performance Is the device fast enough to handle the current and projected traffic? Though the answer to that question varies according to the network configuration, a reasonable minimum for router performance in networks with a normal traffic load is 4,000 64-byte PPS or 750 1,518-byte PPS flowing between any two local network connections. The router's performance over wide-area links should be limited by the data rate of the link and not by constraints in the router itself.

Reliability As multiprotocol data networks become the backbone of enter-

CALL ABOUT OUR NEW CD ROM BACKPACK!

NOW BACKPACK IS SMALLER, AND FASTER.



We've just made it easier to backup your hard drive with our 250 MB parallel port tape backup unit. One model works with all PC compatibles and portables.

Here's why:

Backpack is easy to install. Plug Backpack into the parallel printer port. Then plug the printer into Backpack!

Backpack requires no cards.

Backpack is 30% smaller (1-1/2 h x 4 w x 7-3/4 l).

Backpack is easy to transport and share between computers (2-1/2 lbs).

Backpack can backup at a speed of up to 9 MB per minute.

Backpack is a QIC 80 compatible and can read QIC 40 tapes.

So don't get left in the dust. Call for more information today.

Micro Solutions, 132 W. Lincoln Hwy., DeKalb, IL 60115, 815-756-3411, FAX: 815-756-2928

backpack

MicroSolutions
Computer Products

CIRCLE 005 ON READER SERVICE CARD

prise networks, reliability becomes all the more important. In most networks, an outage of more than a few hours would cause major disruptions of a company's operation.

But in a growing number of cases, the same can be said of an interruption of more than a few minutes. Router vendors are beginning to recognize this and build devices with much higher Mean Time Between Failure (MTBF) and much lower Mean Time To Repair (MTTR). Though MTTR requirements will vary, depending on the site, they should not exceed an hour.

The logical resolution of this trend is in the fault-tolerant capabilities now starting to be offered, for example, in the routers sold by Corel Systems Corp. and Wellfleet Communications.

Cisco has just announced a new fault-tolerant central router, the Cisco 7000 Internetwork Router, as a response to the routers from Corel and Wellfleet. The 7000 will provide fault tolerance and support as many as 30 Ethernet and 20 Token-Ring networks.

Standards tracking Many varieties of standards are relevant to the functioning of routers. Most of the protocols in use are vendor-defined. TCP/IP and OSI, however, are defined by standards groups. Router vendors must be able to track the changes in these protocol definitions. Router vendors can (and have) made changes overnight that can render a network nonfunctional until the router vendor can create and distribute updates. The update processes for TCP/IP and OSI are much more formalized than the update process of proprietary protocols, but changes do occur. The standards-tracking history of the prospective router vendor should be checked to see how rapid it has been at implementing changes.

Documentation As with any complex electronic device, frequent reference will be made to the vendor-supplied documentation. Can you find the information you need in the manuals? Do they have indexes? When you do locate the information, does it include explanations as well as merely instructions? IBM's routers had some of the best documentation we've seen. Its manuals included a series of appendices in the back, listing valuable MIB information.

Vendor Support Even the most reliable router with the best documentation requires support from the vendor. Does the vendor have support-response-time guarantees that match the uptime requirements of your network?

Can you use e-mail to ask technical questions and to report bugs, or do you have to call long-distance on your nickel? (Or worse yet, do you need to use a 900, pay-by-the-minute number.)

As we discovered, getting your hands on a router can be difficult. Many of the most successful router vendors, such as Cisco, are comparatively lean organizations that operate on a three-to-six-week backlog. For larger orders, delivery time may, obviously, be reduced. Still, leave plenty of time beween when you order these products and when you need them.

LOOKING AHEAD

With speed on individual networks at maximum capacity, vendors are turning their attention to reliability, ease of use, and increased protocol and interface support. Those are the issues that will drive the products covered in the following reviews over the next 12 months.

Advanced Computer Communications

ACS 4200

BY TOMAS KREJCI

You've probably seen bridges and routers explained with the OSI model and compared to post offices and telephone systems. Now, imagine a supermarket model. Traffic flow can be visualized as shoppers wading through checkout lines. Router features correlate to the selection on the shelves, and the company's product line determines whether it is a warehouse or a Mom-and-Pop corner grocery store. Advanced Computer Communications (ACC) might be compared to an upcoming neighborhood market with reasonable variety and an interesting specialty section, but short a couple of clerks and possibly your second-favorite flavor of frozen yogurt.

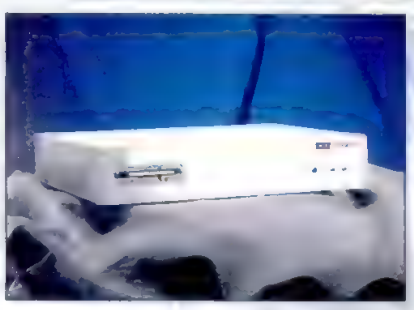
ACC provides a range of moderate-performance bridge-router products, from reasonably priced standalone boxes to more expensive hub-style solutions. Excellent support is provided for most protocols with the exception of Banyan VINES.

Management is accomplished through a typically cryptic command line interface, but this drawback is offset by a logical design and easy access to powerful features. Innovative bandwidth-optimization techniques promise to improve wide-area network performance.

SUITABILITY TO TASK

ACS 4200

	POOR	FAIR	GOOD	EXCELLENT
Flexibility	●	●	●	○
Documentation and support	●	●	●	○
Basic configuration	●	●	○	○
Advanced configuration	●	●	●	○
SNMP management	●	●	○	○
Console management	●	●	○	○



FACT FILE

ACS 4200

Advanced Computer Communications, 10261 Bubb Rd., Cupertino, CA 95014; 408-864-0600; fax, 408-446-5234

List price: $6,500 (includes two Ethernet cards and one WAN card).

Requirements: None.

In short: The ACS 4200 is part of the Series 4000 multiprotocol bridge/router family. It is well suited for multiprotocol bridge/routing on a LAN connecting into a WAN, but LANs with heavy traffic will see slow performance. All major network protocols but VINES are supported. Custom filters are supported, and a queuing technology offers predictive service and network stabilization.

500 ON READER SERVICE CARD

Although local bridging and routing can be performed over both Token-Ring and Ethernet, ACC's expertise clearly lies in the WAN arena. Two of the company's products support local routing. The ACS 2100 bridge-router can route only IP. The full-featured ACS 4200 can be used as a local router and was examined for this article. Its performance is adequate for remote connections and perhaps a couple of LAN circuits. But it is definitely not suitable for sites with multiple LANs running heavy traffic, since collapsed backbone designs are not feasible.

Each router is aware of the addresses of stations on its locally connected network.

Except for the hub-style ACCes/4500, ACC's products have box-style casings with single power supplies. A variety of interface cards are available, but not on all platforms. Besides Ethernet and Token-Ring LAN cards and the usual serial WAN cards supporting X.25, frame-relay, T1, and other common U.S. data links, European-standard WAN cards are available. The modular design is definitely an improvement over hard-wired I/O boards, but nonetheless the cards proved a bit tricky to install.

The ACS 4200 uses a 25-MHz Motorola 68030 processor with 2.5MB of RAM. This design provides limited horsepower for high-bandwidth demands. Speed is important for local routing; however, wire-speed routing can be accomplished with current technology. But the product we saw didn't begin to approach even those speeds. Local performance was generally lackluster.

Remote routing is a completely different story because of the slow serial lines. Here, the ACS did quite well, since raw horsepower is not the primary issue. The ACS offers prioritization filtering, and ACC has taken matters a step further with an innovative technology called Express Queuing, which will be available by the time you read this. For networks, the effect is likely to stabilize traffic flow and offer more fair service than first-come, first-serve queuing. If that's not enough, data compression and Ethernet frame compression are also available. Even without these bandwidth optimization techniques, ACC's filtering is truly impressive.

The usual litany of protocols and RFCs are supported. We tested the routing of IP, IPX, and AppleTalk without experiencing any problems. The tests used software Version 5.1; the next major upgrade (Version 6.0) will soon be released. Some of the less common protocols, such as Banyan VINES and OSI routing, are unavailable. ACC has demonstrated interest in standards activities and was an early participant in tests of the OSPF routing protocol for IP.

All configuration and monitoring is performed at the command line interface, which is structured in a logical fashion with sensible abbreviations. A handy feature is the ability to make configuration changes and easily check the results; this sounds fundamental, but it's not as common as one might think. A sparse on-line help and Quick Reference cards are available to provide reminders.

The power of the command language becomes evident during troubleshooting. Important statistics and information are readily available to the manager. For example, in case of a NetWare problem, you can easily view screens that show statistics from the physical port, IPX (the network layer), SAP (the service advertising protocol), server tables, routing tables, and a host of other items.

Management is performed via terminal or terminal emulator. The manager can use PC-based communications software with a scripting language (such as HyperAccess/5 or Procomm Plus), so common commands can be hot-keyed. Once configured with basic IP information, remote sessions can be established, and routers anywhere on a WAN can be easily monitored. Many of the management commands require a follow-on Reset command in order to take effect, but the process is nearly instantaneous with minimal disruption to traffic.

Extensive SNMP support is provided, but it is via the obsolete MIB I (with a very large private extension), rather than the widely implemented MIB II. Surprisingly, a number of Set commands have been implemented, raising the spectre of security problems. MIB II support is promised for early 1993.

Documentation includes an installation guide, configuration guide, command reference guide, and a series of quick-reference guide folders. A series of technical overview pamphlets covers various issues. Illustrations are a bit primitive and rather scarce. The configuration guide provides a decent section on general routing concepts, configuration worksheets, and step-by-step examples. A glossary of network terms is included, but no index. ACC offers a toll-free technical support line and BBS access. For more help, training classes that include hands-on lab experience are held regularly.

The ACS 4200 is well-suited for providing multiprotocol connectivity over wide-area networks and limited local area networks. LANs with heavy traffic will be hindered by slow performance. Its flexibility and moderate pricing make it a good buy now, and the company's innovative bandwidth-optimization makes it a product worth watching in the future.

Cisco Systems Inc.

AGS+/4

BY GEORGE PORNARAS

When it comes to routers, network managers typically think Cisco, and when they think Cisco they think the AGS+/4, the preeminent product in the bridging and routing market. Its excellent performance, strong protocol support, wide range of LAN and WAN interfaces, and top-notch documentation are hard for any network manager to pass up.

It's not perfect, though. The AGS+ lacks the fault tolerance of some of the newer central routers, a fact that Cisco recently addressed with its new Cisco 7000 router. What's more, the Ethernet performance of the AGS+ is suprisingly low. Configuration is also made difficult and nasty by a command-line configuration editor that is coupled with a rigid and unforgiving setup program. Finally, Cisco's reluctance to respond to new industry standards doesn't bode well in this competitive field.

Still, as the standard by which all routers are measured, the AGS+/4 is a must-see if you're considering a central router for your network.

The AGS+/4 offers blazing performance in many environments. This is due to its unique hardware architecture. High-performance protocols, such as IP, run off of a high-speed processor called the CiscoBus controller. Newer protocols, such as OSI, initially run on a slower processor, the 25-MHz Motorola 68040.

SUITABILITY TO TASK

Cisco AGS+/4

	POOR	FAIR	GOOD	EXCELLENT
Flexibility	●	●	●	●
Documentation and support	●	●	●	●
Basic configuration	●	●	●	○
Advanced configuration	●	●	●	○
SNMP management	●	●	●	●
Console management	●	●	●	○

These two processors are linked by a 533-Mbps data bus and a system-wide Multibus and can use up to 16MB of RAM and 1MB of ROM. Hanging off the bus are four high-speed and two low-speed card slots, connected via the Multibus Interface adapters (up to two dozen can slide into these slots). Each adapter has a separate 16 MIPS Very Large Instruction Word (VLIW) bit-slice processor to speed up packet processing. Three additional bus slots are reserved for the Motorola processor, the CiscoBus controller, and the environmental controller.

Interface adapters run the gamut. In fact, the AGS+/4 supports virtually every known LAN and WAN interface (except ARCnet). Add to that Cisco's support for almost any type of hardware, as well as its pledge to support any market-strategic protocol or interface, and you see why Cisco rules the router world.

But the AGS wasn't quite king of the test-bed, though it was the only device that completed all 96 performance tests. While the AGS+/4 proved extremely effective in handling all protocols over Token-Ring, it was slightly less effective in the traditional Ethernet environment.

Single stream for IP, IPX, and DECnet didn't pose a problem; the AGS+/4 passed 95 percent of the theoretical capacity. OSI performance was substantially lower at 15 percent, making the AGS+/4 inappropriate for OSI traffic. Cisco attributes the performance to a header option in the OSI packet, an option often present in OSI and DECnet Phase V networks. Cisco recommends using its CiscoBus or its soon-to-be-released 7000 model for OSI routing.

Single-stream routing is far less important for central routers than the ability to handle multiple streams. The AGS+/4 was a strong performer in many but not all multiple-stream tests. IP performance degraded only slightly; with both four and six data streams, 85 percent of the maximum number of IP packets were forwarded. It also handled DECnet bridging and routing effectively. The AGS+/4 was able to bridge 40 percent of the four-Ethernet stream and 25 percent of the six-Ethernet stream, and it routed 30 percent and 20 percent of the traffic from four and six Ethernet streams, respectively.

However, OSI performance was virtually nonexistent. The router handled just three percent of both four and six Ethernet streams. The AGS+/4 had poor throughput (52 percent of the Ethernet's capacity) but a very high forwarding rate. WAN performance was fine for both 56 Kbps and T1. Bridging was poor. The AGS+/4 had the lowest latency of the routers tested.

The configuration editor is linear in design, allows for no mistakes, and makes configuration of the AGS+/4 difficult. There is no quick-configuration program. The editor seems out of place because Cisco is usually meticulous about updating its software, as shown by its long list of supported networking protocols.

PROTOCOL SUPPORT

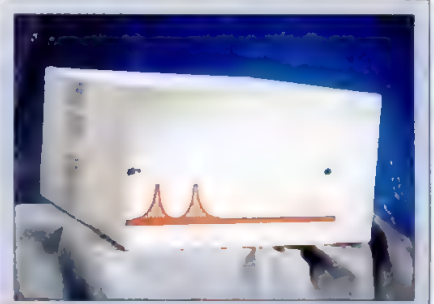
The AGS+/4 supports more than 20 network protocols, including IP, IPX, AppleTalk II, DECnet, OSI, VINES, and SDLC transport. It also supports every conceivable routing protocol (including OSI IS-IS and ES-IS, RIP, EGP, BGP, RTMP, and OSPF) and management protocol (SNMP, Telnet, and TFTP).

Cisco has delayed providing support for some of the new standards that encourage interoperability: OSPF and OSI's Integrated IS-IS routing protocol are two examples. Support for both was delayed in deference to Cisco's own proprietary IGRP protocol.

SNA TO RIVAL IBM

But Cisco's support for other protocols is beyond reproach. For example, its support for SNA/SDLC networking is phenomenal: Cisco truly understands the IBM environment. No other vendor, except perhaps IBM itself, implements SNA internetworking this well.

As with IBM's Data Link Switching (DLS) technique, SDLC traffic is gracefully handled by the AGS+/4 in the multiprotocol internetworking domain. There are a number of different techniques used. Cisco uses local termination via poll spoofing, in which the router responds to the host's requests, not to the terminal. This last technique provides a number of benefits, including greater flexibility in network design and more efficent data



PC EDITORS' CHOICE

FACT FILE

Cisco AGS+/4

Cisco Systems Inc.,
1525 O'Brien Dr., Menlo Park, CA 94025;
800-553-6387, 415-326-1941;
fax, 415-903-7555

List price: $25,750 (with one Token-Ring port, two Ethernet ports, five WAN ports, and 16MB RAM)
Requires: VT100-compatible terminal emulator
In short: The AGS+/4 is the preeminent central router on the market today. With capacity for up to 28 LAN or 20 WAN interfaces and a full package of protocols, the AGS+/4 offers wide user application support. Cisco's IBM internetworking is second only to IBM's, and its OSI support is second only to DEC's. Management options, which are handled through SNMP, Telnet, or TFTP management protocols, are flexible and complete.

901 ON READER SERVICE CARD

ProTracer. Where the qualities of a laser printer meet the output of a large format plotter.

Laser printers offer so much. Like high quality output, speed, desktop convenience and, of course, a low price. Large format plotters, on the other hand, give you the output size you need for certain drawings and applications. What we've done is pulled all of these features together to create ProTracer™ — a personal printer and plotter that produces A, B, and C-size output at an impressive 360 dpi resolution.

FEATURES INCLUDE:

- High performance Canon® inkjet engine
- Fast, Intel i960™ processor—drawings that take over one half hour on pen plotters take as little as five minutes on ProTracer!
- Optional accessories including a new, faster HP-GL® language emulation card, PostScript® language emulation, memory expansion boards, and sheet feeders
- Full vellum capabilities
- Unsurpassed customer service — 60-day money back guarantee, one year warranty, and unlimited technical support

ProTracer base unit	ProTracer with HP-GL	ProTracer with PostScript emulation
• Customized ADI and PADI drivers for AutoCAD users • Epson and ProPrinter emulations	• ProTracer base unit • HP-GL emulation card plus memory	• ProTracer base unit • PostScript language emulation card • 8 MB memory
$1499	**$2249**	**$2897**

For the bigger picture, call Pacific Data Products at (619) 625-3573, Fax (619) 552-0889.

PACIFIC DATA PRODUCTS

9125 Rehco Rd., San Diego, CA 92121. In Europe, call (353-61) 47 3609.
Pacific Data Products Inc. All other brands and product names are registered trademarks of their respective manufacturer. Image courtesy of Intergraph Corporation. FeatureStage™, the advanced imaging Operating System based on Sun Microsystems' NeWS® technology, is a registered trademark of Phoenix Technologies Ltd.
Pacific Data Products Inc.

transfers across the networks.

Individual transmit-receive data-throttling session queues give the AGS+ SDLC WAN traffic transport capability.

SNA priority and Class of Service routing (a type of prioritization that allows the router to give priority to, and to respond differently to, traffic coming from particular groups) ensure sufficient bandwidth for SNA traffic in a multiprotocol environment. Source-route and source-route/transparent bridging allow the AGS+/4 to route Token-Ring packets in mixed Ethernet and Token-Ring environments.

The AGS bridges the protocols it cannot route. Every type of bridging is supported: encapsulation for tunneling over backbones or WAN links; translational/transparent bridging for making peers out of disjoint MAC-type network devices; and source-route/transparent bridging for enabling SDLC transport over Token-Ring as well as Ethernet, FDDI, and WAN links.

NETWORK MANAGEMENT

Management functions are handled through monitoring software, which has full MIB II support, and by the built-in debugger. Conditions monitored include active router and protocol status, packet traffic statistics, interface status, packet logging, trace, Telnet, and ping commands. The router supports four levels of protocol priorities to ensure optimum queuing order. And Cisco's support for access restrictions is second only to Network Systems' BCF/PCF technology.

Documentation is well-executed. Even the product brochures have educational value. The manuals are carefully organized, thoroughly consistent, and profusely illustrated with diagrams and examples. And though the Cisco sales force has a notoriously haughty attitude toward potential customers, tech support under a Cisco maintenance contract is wonderful. It includes a toll-free support line and BBS support.

If you are just beginning to explore internetworking, you should know that Cisco's products form the standard against which all others must be measured. The AGS+/4 is a solid router; its future will depend largely upon the company's approach to an increasingly competitive market.

Clearpoint Research Corp.

Constellation Pixis

BY GEORGE PORNARAS

The most compact standalone bridging router on the market, the Constellation Pixis packs a wallop. Its form factor makes the Pixis attractive for offices where wiring closet space is scarce, and its quality makes it an excellent router for virtually any multiprotocol office.

You'll find the Pixis easy to install, easy to configure, easy to maintain, and easy to afford at $7,745. It does lack support for Token-Ring networks, and OSPF was not available during our testing period. An off-line configuration storage facility would be welcome, and the context-sensitive on-line help is limited. But the power of its subnet bridging and routing, which is a hybrid of Ethernet switching and simultaneous concurrent bridging and routing, leave an excellent impression.

The Clearpoint Constellation product line comprises four products: The Pixis and Little Dipper are standalone units, while the Auriga and Carina are board-level products for Extended Industry Standard Architecture/Industry Standard Architecture (EISA/ISA) and VME systems, respectively. The Auriga and Carina can take up a card slot on the host system or can be used in a standalone router. Both use only the power supply of the VME or ISA/EISA bus into which they're inserted. All the units perform essentially the same way, but the Little Dipper has the highest fan-out capability (up to 16 Ethernet ports).

Contained within the Pixis' 12- by 7.75- by 1.5-inch fixed chassis are four Ethernet ports, a 256-Kbps WAN interface, and a serial console port. It has an AMD29005/16MHz RISC processor, and a 120Mbps parallel-bus based design with a common memory architecture. The memory space consists of more than 1.5MB of static RAM and 256K of parameter-storing NVRAM. This is coupled with software that allows the machine to reboot in a third the time of most routers, along with a menu-driven configuration, monitoring, and management system.

With all this power crammed into such a tiny space, it's almost possible to overlook the fact that the Pixis is a full-function router, moving IP, IPX, XNS, and (by the time you read this) AppleTalk II packets. However, because it employs the less-powerful RIP protocols for router maintenance instead of the OSPF protocol, it is not yet suitable for large internetworks. The company expects to be shipping the Pixis with OSPF support by the time you read this. The router also has SNMP, Telnet, Hello,

SUITABILITY TO TASK

Constellation Pixis

	POOR	FAIR	GOOD	EXCELLENT
Flexibility	●	●	○	○
Documentation and support	●	●	●	○
Basic configuration	●	●	●	○
Advanced configuration	●	●	●	○
SNMP management	●	●	●	●
Console management	●	●	●	○

PC MAGAZINE EDITORS' CHOICE

FACT FILE

Constellation Pixis

Clearpoint Research Corp.,
35 Parkwood Dr., Hopkinton, MA 01748;
800-253-2778, 508-435-2000;
fax, 508-435-7390

List price: $7,745 (includes four Ethernet ports and one WAN port); frame relay or X.25 WAN port, $250
Requires: VT100 terminal emulator.
In short: This is an inexpensive, full-bandwidth, peripheral bridging-router. The unit we saw supports only the Appletalk II, IP, IPX, RIP, and transparent bridging protocols, and its port configuration is limited. But its slim case and simple configuration give it a high price/performance value. This unit is recommended for workgroup networks of fewer than 100 nodes that will eventually connect to a larger backbone environment.

502 ON READER SERVICE CARD

SAP, and EGP management support.

In the peripheral-router category, the Pixis shows solid performance. On a single stream, Pixis proved excellent at bridging and routing IP traffic. For IPX, it handled 70 percent of Ethernet's theoretical capacity; not extraordinarily effective, but impressive nonetheless. Latency was also very low. Though WAN tests were not run on the Pixis, they were run on the Datability's DXA 550, an OEM of Pixis. Not surprisingly, the DXA 550 had similar performance numbers on the Ethernet. It was also very effective in bridging traffic across the WAN.

INSTALLATION

Installation is a snap. Physical installation is literally plug-and-play. Switching on the machine brings up the configuration menu. There is no separate option for quick configuration, but the text-driven menu system is easily navigated with little or no help from documentation. However, supplying some typical values or examples would help the user through some of the more arcane menus. The Pixis also provides no method of storing the basic system configuration file off-line other than downloading it to another Pixis.

By looking at the network address, routers can gather additional information to help make the forwarding decision.

This ease of use is impressive when the sophistication of the Pixis' bridging and routing facilities is taken into account. The Pixis can be configured to simultaneously bridge and route over several of its ports, which are treated as a single subnet. This allows multiple ports to be grouped together into a single logical bridging router, so that, for instance, the four bridging ports and one WAN port of the unit can be set initially to route to all five simultaneously as a single five-port bridge. The manager can partition off and merge several of those ports to form a subnetwork without affecting the other ports.

The Pixis ably serves smaller offices: The Little Dipper, with the same subnetwork capability and with potential for up to 48 connections, has the potential to handle enterprise-style routing. The Dipper strings together several Pixis-like units (up to eight two-port Ethernets for a total of 16 ports, or eight six-port WAN boards for a total of 48 ports) in one standalone package. Optional RS-422, RS-449, RS-530, or V.35 WAN ports (up to three); support for the EGP protocol; and the promise of DECnet, OSPF, and IS-IS protocol support in the first quarter of 1993 round out the Little Dipper's potential for this wider router market. The company is expected to announce T1/E1 support in 1993.

Router-management access is rarely simple, but here again the Pixis sparkles. It allows for both direct and remote viewing of key system, routing, bridging, and other protocol parameters. IP, SNMP, ARP, TCP, Telnet, and host table information can be viewed either through the network with SNMP or Telnet or through a directly connected Telnet console into the router's Network Protocol menu screen. In either case, the password-protected screens supply packet, error, and routing protocol statistics in an easy-to-manipulate tabular form. Status, routing table info, and packet statistics are also accessible using both modes.

SNMP GET/GET NEXTs (but not SETs) are also supported. Using HP OpenView (the vendor doesn't produce its own proprietary management station, though its StarWatch software works with OpenView), managers have ready access to both the standard MIB II variables and some of the MIB extension variables. Full SNMP configuration capability should be available by the time you read this; many MIB II extensions are already incorporated.

The Constellation Pixis' clean, compact design and all-in-one architecture prove that solid peripheral routers can come in small packages. Yet the Pixis is a big router: big on features, functionality, and promise. With its basic yet comprehensive list of supported protocols, it has the requisites for internetworking as well as for standard workgroup use.

Hewlett-Packard Co.

HP Router ER

BY ROBERT LIPSCHUTZ

Despite bright spots such as its quick-configuration editor and its performance, Hewlett-Packard's Router ER won't dazzle you. A fixed configuration prevents expansion, and a clumsy configuration editor makes $8,000 seem a bit much for this peripheral router.

The Router ER has a fixed configuration of two Ethernet ports and two WAN ports. The quick-configuration screen and portions of the documentation are good, but not good enough to make up for the unintuitive configuration editor. The ER offers excellent SNMP support and robust WAN capabilities, including Switched Multi-megabit Digital Service (SMDS).

The core of HP's code comes from Wellfleet Communications, though certain aspects have been added. Most obvious among these is an excellent quick-configuration program. The ER has a 68020 processor running at 25 MHz on the motherboard, which uses a shared-memory architecture. The system is sold in a fixed architecture, available in mixtures of either three or four Ethernets. Its bridging and routing of IP speeds were fine, forwarding 50 percent of Ethernet's theoretical maximum generated traffic. DECnet and IPX performance were slightly lower at 36 and 30 percent, respectively. WAN performance was fine; as a bridge, the ER was able to deliver 85 percent of the Ethernet's capacity. It was able to route all IP traffic.

UP AND RUNNING

Just plug the ER in and away you go: not even a power switch to stand in your way, and plenty of status lights to guide you. When you turn on your terminal, the router brings up a menu, a welcome change from the common command-line interfaces.

HP has a terrific quick-configuration option, second only to IBM's in usability. All the parameters required to construct a basic configuration are on one screen. The unusually good context-sensitive online help may be toggled on and off, and

The *Evolution* Of P

1984

The Luggables

- 35 pounds
- 8088-class CPU
- 512K RAM
- Floppy drive
- No hard drive
- AC only
- Monochrome display

$4000 to $5000

1987

The Laptops

- 15 to 20 pounds
- 8088 or 80286-class CPU
- 640K RAM
- Floppy drive
- 10 or 20MB hard drive
- AC only or 1.5-hour battery
- CGA display

$3500 to $4500

You've been wrestling with over-sized, over-priced portables for nine long years! Now Gateway 2000 emerges from the struggle and introduces the missing link in the evolution of portable computing. It's the HandBook, a perfect combination of portability and functionality for all on-the-go Homo Sapiens.

The HandBook is a real PC in a revolutionary new form. Not a notebook, not a palmtop, the HandBook is the first fully-functional PC in a truly portable, handbook-sized form. You can easily take the HandBook anywhere because this new species measures a mere 6 x 10 inches and weighs only 2.75 pounds, yet it runs over 5,000 of your favorite DOS applications. You aren't stuck buying and learning proprietary "card" programs when you have a HandBook.

The exclusive auto-resume feature enables the HandBook to work like no other PC you've ever seen. Auto-resume allows you to suspend the computer's operation for moments or weeks at a time, and then return to your work right where you left off – in seconds, and at the touch of a button.

With the HandBook you get 40MB of hard disk capacity to easily and quickly store all your DOS programs and files.

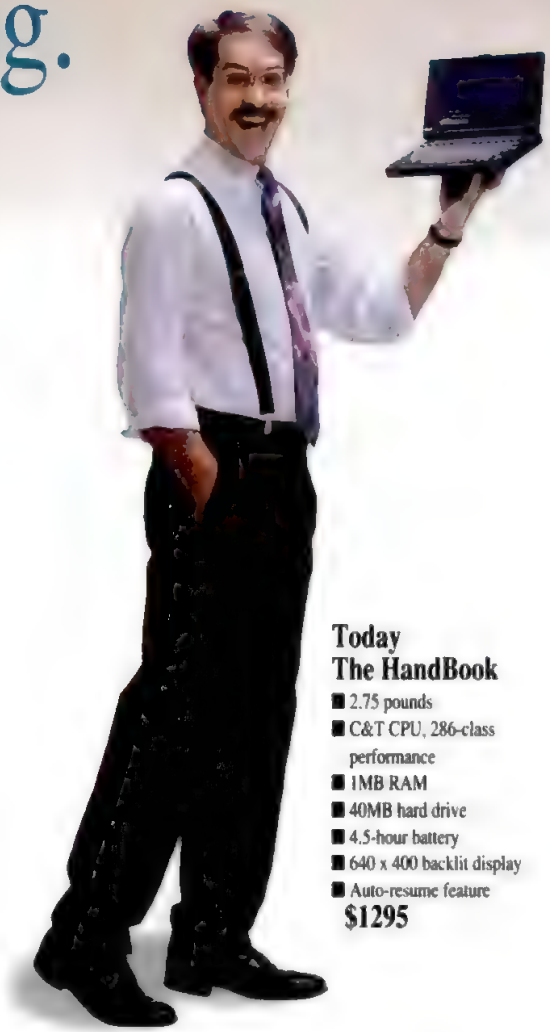
The quiet and comfortable touch-type keyboard allows you

ortable Computing.

1990
The Notebooks

- 6 to 9 pounds
- 80286 or 80386SX-class CPU
- 640K RAM
- Floppy drive
- 20 to 40MB hard drive
- 2 to 3-hour battery
- CGA or VGA display

$2900 to $4500



Today
The HandBook

- 2.75 pounds
- C&T CPU, 286-class performance
- 1MB RAM
- 40MB hard drive
- 4.5-hour battery
- 640 x 400 backlit display
- Auto-resume feature

$1295

to type as fast as you can on your desktop keyboard.

The HandBook's 640 x 400 resolution backlit screen can be read in virtually any light and is large enough to display full 80-column lines of text, so you can use the HandBook whenever and wherever you need to. And the HandBook gives you all this with up to 4.5 hours of life on a replaceable battery.

The Gateway HandBook was designed specifically for you – today's on-the-move computer user. Once you get your hands on a HandBook, you'll struggle no more with a Neanderthal artifact

The HandBook was named one of the year's "Best of What's New" products by Popular Science *magazine and received* BYTE *magazine's Award of Distinction.*

GATEWAY2000

"You've got a friend in the business."

8 0 0 - 8 4 6 - 2 0 0 0

610 Gateway Drive • P.O.Box 2000 • North Sioux City, SD 57049-2000
605-232-2000 • Fax 605-232-2023

©1992 Gateway 2000, Inc., HandBook is a trademark of Gateway 2000, Inc. All other brands and product names are trademarks or registered trademarks of their respective companies

though the program does not enter information for you, it is able to detect incorrect entries for such things as subnet masks. This screen may be used to configure IPX, IP, AppleTalk, DECnet Phase IV, and bridging, and to enable Telnet access and SNMP support.

However, when the time comes to perform such tasks as enabling OSPF, setting IPX SAP filters, and adding multiple AppleTalk zones, you'll need the configuration editor. Here your troubles will begin. The configuration parameters for each protocol are scattered over many screens, for example, and adding an IPX filter takes more than ten steps.

Despite this badly conceived interface, HP's filtering capabilities provide flexibility. You can enable SAP filters by server or network, and traffic filters by destination address, source address, or socket number. Similar flexibility exists for IP and AppleTalk, but the ER does not allow protocol prioritization of the type offered by several of the other packages we reviewed. HP allows you to define lists of networks, hosts, sockets, and packet types to ease filtering configuration for activities such as restricting access to particular networks. But a complete lack of on-line help and little explanation in the documentation leave those unfamiliar with filter creation at a disadvantage.

SUITABILITY TO TASK

HP Router ER

	POOR	FAIR	GOOD	EXCELLENT
Flexibility	●	●	●	○
Documentation and support	●	●	●	●
Basic configuration	●	●	●	○
Advanced configuration	●	●	●	○
SNMP management	●	●	●	●
Console management	●	●	●	○

The HP Router ER supports bridging both between Ethernet networks and also between Token-Ring networks, but not translational bridging between a Token-Ring and an Ethernet network. Routable protocols are unaffected, but don't try bridging IP between Ethernet and Token-Ring.

HP makes HP OpenView a leading SNMP management-station software package. It makes sense that the company would have good SNMP support built into its router: it supports the entire MIB II specification and uses Wellfleet's private MIB, which addresses areas such as IPX, AppleTalk, bridging, and FTP. The private MIB provides helpful information such as the number of forwarded IPX packets and IPX error packets.

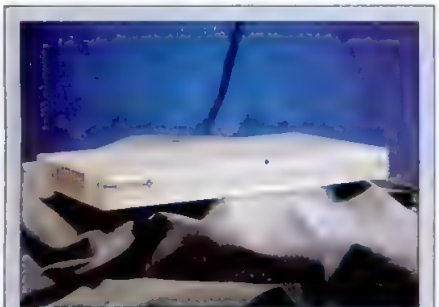
For easier viewing of these and other statistics, HP sells Interconnect Manager, a separate package for an OpenView station that presents a graphical representation of the back of the router and of the router statistics gathered. When certain user-definable parameters for a particular port, such as a given number of error packets, are reached, the graphical port will change colors and an alarm will sound.

The router may also be managed through the console port or through Telnet. HP offers password protection. A clear button on the back clears all passwords in case you forget; this assumes, correctly, that the greatest danger of tampering comes from hackers Telnetting into systems. You may also disallow Telnet access altogether. Once logged into the router, you may view router statistics by port or by protocol with the Statistics Screen Menu.

The ER's event log displays its messages in mercifully plain English. Typical messages note, for example, when a network interface has been enabled and when carrier sense has been lost on an Ethernet port. Event-log filtering allows specific types of messages to be shown. The router supports both IP ping and AppleTalk Echo in its Network Control Language Interpreter section, where the user may set router passwords, conduct a Telnet session, display the basic configuration, perform SNMP maintenance, and reboot the router.

The ER's documentation is well-organized and includes many informative diagrams. An installation guide, configuration guide, operator's guide, and even a training disk are included, but only the configuration guide is indexed. The technical reference guide contains invaluable information, including a question-and-answer section. Unfortunately, as with the documentation for the other packages we saw, little information on network protocol filtering is given.

Hewlett-Packard has made an effort to make this router easy to use, with good documentation, computer-based training, and a quick configuration with on-line help. The mundane configuration editor, however, was as unpleasant to use as most of the rest of its kind. More seriously, the router lacks modularity, which forever brands it as a peripheral router. In that category, it is an acceptable, if overpriced, package.



FACT FILE

HP Router ER

Hewlett-Packard Co., Roseville Networks Division, 8000 Foothills Blvd., Roseville, CA 95747; 800-752-0900; fax, 800-333-1917

List price: $8,000 (with two Ethernet and two WAN ports and 5MB RAM)

Requirements: VT-100 terminal

In short: HP offers an excellent Quick Configuration utility with context-sensitive on-line help. A poorly designed configuration editor brings HP back toward the pack, as does its $8,000 price. The unit has excellent SNMP support, including MIB-II, private MIB, and an application (Interconnect Manager) that runs under HP OpenView. Good WAN support, including SMDS, solidifies this device's place among peripheral routers.

503 ON READER SERVICE CARD

IBM Corp.

IBM 6611 Network Processor 140

BY GEORGE PORNARAS

A GUI on a router? It hardly seems possible. But whether or not you choose to use the off-line configuration editor that runs under Microsoft Windows 3.1*x* or X-Windows, the IBM 6611 Network Processor's configuration editor is downright attractive. Moreover, IBM's foray into the world of routers stands out not only

Glossary

APPC Advanced Program-to-Program Communications, IBM's proprietary network protocol that can be used to support a form of distributed computing.

APPN Advanced Peer-to-Peer Networking, IBM's proprietary network protocol that allows network nodes to interact without a host computer

AUI Attachment Unit Interface, the connector used to attach a device to an Ethernet transceiver

BGP Border Gateway Protocol, a routing protocol designed to replace EGP. Unlike EGP, BGP weights each route BGP is used to interconnect organizations.

BNC A locking-type connector. Thinnet, a form of Ethernet, uses BNC connectors.

DECnet Digital Equipment Corp 's proprietary network protocol

EGP External Gateway Protocol, a routing protocol that is used to exchange network reachability information among organizational networks. EGP indicates whether a network is reachable; it does not weight that decision

FDDI A standard for a 100-Mbps LAN based on fiber-optic media configured as dual counter-rotating token-rings. The Fiber Distributed Data Interface is defined for fiber-optic cable, but will soon be available over shielded and unshielded twisted-pair cable.

Filter The ability to selectively forward data based on criteria specified by the network manager

FTP A TCP/IP protocol that is used for basic operations such as logging on and copying files

IETF Internet Engineering Task Force, the organization that produces the standards used in TCP/IP and the Internet

Integrated IS-to-IS A routing protocol that combines routing for TCP/IP and OSI protocols It is a superset of IS-IS, the OSI routing technology

IPX Although IPX stands for a particular protocol (Internet Packet Exchange), it is normally used to refer to the entire Novell protocol suite. IPX is the Novell equivalent of the IP protocol. It is used to route NetWare packets between LANs

MIB, MIB I, MIB II Management Information Base, the database used by SNMP to monitor and manage networks. MIB I and MIB II are revisions of the database used on TCP/IP networks (The original MIB was renamed MIB I when MIB II was defined.)

OSI The International Standards Organization's architecture for Open Systems Interconnection, a scheme for a standard architecture and protocol suite. OSI consists of seven layers: physical, data link, network, transport, session, presentation, and application. The physical layer deals with the electromechanical interface to the network media The data link layer controls access to that media and defines frame formats and error control over the link Ethernet and Token-Ring are examples of data-link protocols. The network layer provides addressing and forwarding of data between LANs The transport layer adds reliability to the process of sending data being forwarded between LANs. The session layer controls the flow of data between nodes The presentation layer adds structure to the exchange of data, while the application layer manages communications between applications programs.

OSPF Open Shortest Path First routing protocol, used on TCP/IP networks, in which routers maintain an internal map of the network and exchange information about the current state of each network link

Packet vs. Frame Two roughly equivalent terms that refer to a message package

Ping A test in which an ICMP echo request packet is sent to another router; the sending program waits for an indication that the packet has reached its destination

RIP Routing Information Protocol. A routing protocol used on TCP/IP networks that distributes the addresses of reachable networks and metrics reflecting the degree of difficulty involved in reaching particular networks from particular locations.

Routing Protocol The messages exchanged by routers to indicate LAN reachability Reachability can be defined in a variety of ways, depending on the routing protocol. In the case of RIP, reachability indicates the number of routers that sit between two nodes. This information is used to determine the optimum path to all of the LANs in an Internet

SNA Systems Network Architecture, IBM's proprietary network protocol description Devices in an SNA network contain a Logical Unit (LU) and a Physical Unit (PU). The LU is IBM's equivalent of a network address. The PU is the logical address used to manage a node on a network. Devices are commonly connected on an SNA network using the Synchronous Data Link Control (SDLC) protocol, which runs over serial lines

SNMP Simple Network Management Protocol, a standard low-level protocol used to monitor and manage nodes on a network. Currently best defined for TCP/IP networks, it will soon be used on AppleTalk and IPX networks

SNMPv2 A proposal for a revision of SNMP that includes additional security features, the ability to transfer a large chunk of data at once, and the ability to communicate between SNMP management stations.

SRB Source-Route Bridge, a procedure in which a node sending a packet places a path in the packet header to define the path that packet should take through the network.

SRT Source-Route Transparent, a proposed integration of source-route and transparent bridge functions

Subnet Mask A configuration feature of a router that is used to select the portion of a 32-bit TCP/IP node address that refers to the LAN and the portion that refers to the node on the LAN

TCP/IP Transmission Control Protocol/Internet Protocol TCP and IP are two of the standard Internet protocols; the term TCP/IP is often used to refer to the entire Internet protocol suite. TCP/IP is used to exchange data between nodes that support the TCP/IP protocol suite. The IP portion works at the OSI network layer to direct data between nodes on LANs, and TCP provides a reliable transport service TCP/IP is the Internet equivalent of IPX.

Telnet The TCP/IP remote terminal protocol

Tunneling The encapsulation of one protocol within another. Tunneling is often used to transport a LAN protocol across a backbone network that does not support the LAN protocol

for its novelty value but for its elegant, virtually fail-safe off-line approach to configuration.

There are problems with the 6611, a peripheral router, not the least of which is its low performance. Still, with its GUI front end, IBM is certainly providing an attractive, easy-to-use alternative for its mainframe-centric customer base.

Today, IBM customers connect their mainframes through SNA, a networking paradigm that revolves around the host. The 6611 enables IBM's customers to save money by merging their SNA traffic with their multiprotocol network.

The 6611 certainly accomplishes that objective, protecting IBM's SNA turf. But it's also a surprisingly well-developed entry into the internetworking market in its own right.

The 6611 encompasses the basics of current bridge-routing technology. It offers Ethernet, Token-Ring, T1 Serial, X.25, and Synchronous Data Link Control (SDLC) interfaces. IBM has stated its intention to support FDDI and APPN/NN directly within the unit. It supports four cards in the 140 model we tested and seven in the 170. The normal complement of protocols is supported (IP, IPX, DECnet, XNS, and AppleTalk, plus RIP, OSPF, EGP, and PPP), as well as some extras such as frame relay and source-route bridging, but there is no transparent bridging.

FACT FILE

IBM 6611 Network Processor 140

IBM Corp., One Old Orchard Rd., Armonk, NY 10504; 800-772-2227

List price: $13,095 (with two Ethernet ports, four WAN ports, and 16MB RAM) MPNP software, $3,600

Requires: Off-line configuration station with Windows 3.x or X-Windows interface

In short: The device is limited by its nonmodular architecture, but it approaches central-router functionality with its long list of supported protocols. With IBM's excellent technical support team and documentation, as well as IBM's incomparable GUI off-line System Configurator, the 6611 comes highly recommended for both IBM- and non-IBM-based workgroup networks

504 ON READER SERVICE CARD

IBM's strongest suit is its SNA/NetBIOS tunneling over IP (called Data Link Switching, or DLS, by IBM). IBM takes a unique approach to SNA by terminating the host connection at the router. The host does not need to poll the PC running terminal software. The router is responsible for delivering data to and from the client. When the host doesn't have to poll the client, there is less of a chance that the session will time out and lose the connection. This makes DLS more effective than any other approach to passing terminal traffic across the LAN.

SUITABILITY TO TASK

IBM 6611 Network Processor 140

	EXCELLENT
Flexibility	○
Documentation and support	●
Basic configuration	●
Advanced configuration	○
SNMP management	●
Console management	○

PERFORMANCE

More than any other performance feature, the 6611's scalability stands out. The 6611 uses completely separate routing RISC processors for each interface card, so for each network it connects, performance increases proportionally. With two Ethernet networks, for example, the 6611 can route twice as many packets as it can with a single Ethernet network. The interface cards share only the Micro Channel architecture (MCA) bus. This is in direct contrast to most low-end router buses, which generally use a common routing engine that is shared between interfaces.

The unit's performance when it routed IP, IPX, and DECnet packets between two networks was adequate. When connecting six Ethernet networks (three streams), the 6611 maintained the same level of performance. Performance across both a 56Kbps link and a T1 link was excellent.

Surprisingly, the router performed better on an Ethernet network than it did on a Token-Ring. Performance on our IP, IPX, and source-route tests hovered between 20 and 25 percent of theoretical bandwidth. When connecting between Token-Ring and a 56-Kbps link, performance was great for IP and good for source-route bridging. The opposite results appeared when connecting to a T1 link. On the whole, latency was on the higher side for Ethernet frames of maximum size. This higher latency may pose a problem for Novell LANs running without burst mode.

INSTALLATION

Installation of the unit is made easier with the use of the menu-driven context-sensitive help and with the intelligent defaults for network parameters. To ensure that the off-line configuration file is properly set up, the configuration editor uses both record/data checking and window locking. For instance, when the user fills in a field in a lower-level window, the configuration editor gives color cues to indicate all the other fields that are affected by this data entry.

It will refuse to relinquish control to a higher-level window until the required fields are appropriately completed. The data is cross-checked against other data entries and for appropriate format to verify its validity.

There is also a text-driven, menu-based "delayed" on-line configuration system, which allows managers to run untested configurations during off-peak hours. There is no quick-configuration program.

The router supports RLOGIN/RSH clients and servers. It also features dual end-point filters for IP and MAC addresses and SAP/RIP filters for IPX. There are a few things that the 6611 doesn't do, like simple translational bridging and OSI networking. It has no hot-swap capability, WAN compression, or protocol prioritization. IBM does claim protocol prioritization, but that only applies to protocols within SNA, not

The World Standard

An Important Edition ★★★★★ Everything you've been missing

NEW REVELATIONS SHOCK BUSINESS

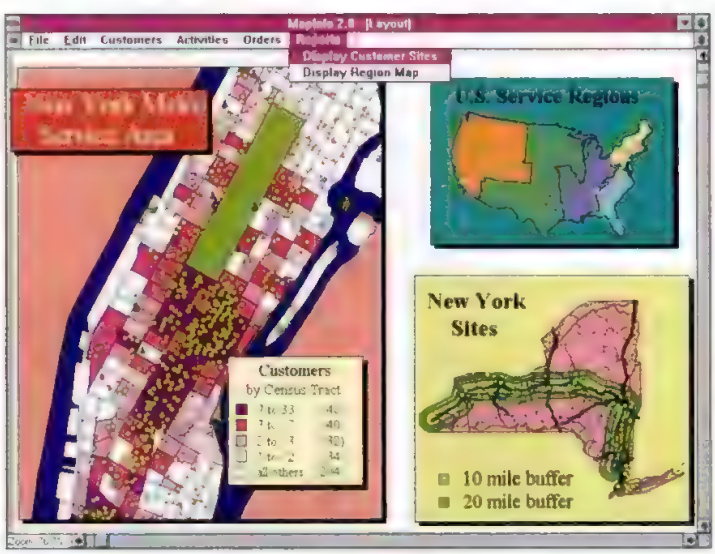
Desktop Mapping Delivers The News

Imagine finding buried treasure in your backyard. That's the kind of impact MapInfo's complete line of desktop mapping software products is having on businesses everywhere.

When you dig a little deeper, it's easy to see why.

85% of all data has a geographic component. By providing the tools to visualize and analyze that data - from a bird's eye view right down to the most minute detail - MapInfo is helping companies pinpoint opportunities they never saw before that were right under their noses.

Suddenly, through geographic analysis, Customer Services can identify specific problem areas and respond with quality, cost-saving service. Sales can respond instantly to changes in the market and restructure territories to optimize customer coverage. Marketing can pinpoint the most lucrative markets for new products and business sites - and target media programs with a precision they've never had before. Over in Operations and Planning, the best options for future expansion show up right on the screen. Talk about hitting pay dirt!



With MapInfo, you can overlay data from dBase (DBF), Lotus 1-2-3, Excel, delimited ASCII, plus many other formats, and relate it to thousands of maps, down to street level on Windows, DOS, Macintosh, Sun and HP.

Catch the World's Most Excellent Desktop Mapping Seminar Tour!

To see how your company can hit pay dirt with MapInfo, call **1-800-460-4265 X250** to reserve your place at a free upcoming seminar.

Or, if you can't make a seminar, call this number – 1-800-358-7676 X255 – (outside U.S. and Canada, 518-274-6000) to see if you qualify for our **free demo disk.** Either way, we promise you a great show.

World's Most Excellent Desktop Mapping Seminar Tour*

Albuquerque, NM	4/21
Atlanta, GA	5/18
Baltimore, MD	4/28
Birmingham, AL	6/9
Boston, MA	4/27
Buffalo, NY	6/3
Calgary, AB	4/20
Charlotte, NC	5/27
Chicago, IL (Downtown)	4/15
Cincinnati, OH	6/2
Cleveland, OH	4/14
Columbus, OH	5/6
Dallas, TX	6/3
Denver, CO	4/21
Detroit, MI	5/4
Freehold, NJ	4/22
Ft. Lauderdale, FL	5/25
Ft. Worth, TX	6/10
Garden City, NY	4/13
Honolulu, HI	4/27
Houston, TX	5/12
Indianapolis, IN	4/20
Irvine, CA	5/25
Kansas City, MO	5/5
Los Angeles, CA	4/13
Memphis, TN	5/11
Milwaukee, WI	5/18
Minneapolis, MN	4/8
Montreal, PQ	5/20
Nashville, TN	6/8
New York, NY	5/4
Norfolk, VA	6/10
Northbrook, IL	5/11
Orlando, FL	4/29
Ottawa, ON	5/19
Phoenix, AZ	4/22
Pittsburgh, PA	5/19
Portland, OR	6/9
Raleigh/Durham, NC	5/6
Reston, VA	6/10
Richmond, VA	4/27
Rochester, NY	5/25
Saddle Brook, NJ	6/2
Salt Lake City, UT	5/20
San Diego, CA	4/29
San Francisco, CA	5/5
Seattle, WA	6/8
St. Louis, MO	4/20
Stamford, CT	4/14
Syracuse, NY	4/28
Tampa, FL	4/22
Toronto, ON	5/18
Tulsa, OK	5/13
Vancouver, BC	4/21
Washington, DC	5/19

Call 1-800-460-4265 X250

MapInfo® CORPORATION

The Standard On The Streets

All trademarks are the property of their respective owners. MapInfo is a registered trademark of MapInfo Corporation.
*Co-sponsored by PROXIMA®

CIRCLE 291 ON READER SERVICE CARD

STRIPPED DO
NOT STRIPPED

NOW $1,399

Lease $52/MO

i486™ SX 25 MHz System
4 MB RAM
170 MB 17 ms Hard Drive
5 Drive Bays • 6 Expansion Slots
Dual Floppy Drives 3.5" and 5.25"
Accelerated Video 512 KB Video RAM
Super VGA 1024i Monitor
14", 1024 x 768, .28mm
MS-DOS 5.0, Microsoft Windows™ 3.1
Mouse

NOW $1,899

Lease $70/MO

i486 DX 33 MHz System
4 MB RAM • 64 KB Cache
170 MB 17 ms Hard Drive
5 Drive Bays • 6 Expansion Slots
Dual Floppy Drives 3.5" and 5.25"
Accelerated Video 512 KB Video RAM
Super VGA 1024i Monitor
14", 1024 x 768, .28mm
MS-DOS 5.0, Microsoft Windows 3.1,
Mouse

intel inside

WN PRICES, DOWN 486s.

DIMENSION 486DX/33

NOW $2,099

Lease: $78/MO.

i486 DX 33 MHz System
4 MB RAM • 64 KB Cache
212 MB (15 ms) Hard Drive
5 Drive Bays • 6 Expansion Slots
Dual Floppy Drives (3.5" and 5.25")
Accelerated Video (512 KB Video RAM)
Ultra VGA 1024NI Monitor
(14", 1024 x 768, .28mm, non-interlaced)
MS-DOS 5.0/Microsoft Windows 3.1/Mouse

DIMENSION 486DX/33s

NOW $2,399

Lease: $89/MO.

i486 DX 33 MHz System
8 MB RAM • 64 KB Cache
212 MB (15 ms) Hard Drive
6 Drive Bays • 6 Expansion Slots
Dual Floppy Drives (3.5" and 5.25")
Accelerated Video (512 KB Video RAM)
Ultra VGA 1024NI Monitor
(14", 1024 x 768, .28mm, non-interlaced)
MS-DOS 5.0/Microsoft Windows 3.1/Mouse

DIMENSION 486DX2/50

NOW $2,299

Lease: $85/MO.

i486 DX2 50 MHz System
4 MB RAM • 64 KB Cache
212 MB (15 ms) Hard Drive
5 Drive Bays • 6 Expansion Slots
Dual Floppy Drives (3.5" and 5.25")
Accelerated Video (512 KB Video RAM)
Ultra VGA 1024NI Monitor
(14", 1024 x 768, .28mm, non-interlaced)
MS-DOS 5.0/Microsoft Windows 3.1/Mouse

DIMENSION 486DX2/50s

NOW $2,599

Lease: $96/MO.

i486 DX2 50 MHz System
8 MB RAM • 64 KB Cache
212 MB (15 ms) Hard Drive
6 Drive Bays • 6 Expansion Slots
Dual Floppy Drives (3.5" and 5.25")
Accelerated Video (512 KB Video RAM)
Ultra VGA 1024NI Monitor
(14", 1024 x 768, .28mm, non-interlaced)
MS-DOS 5.0/Microsoft Windows 3.1/Mouse

*Available while supplies last. Leasing arranged by Leasing Group, Inc. The Intel Inside logo is a registered trademark and i486 is a trademark of Intel Corporation. MS-DOS and Microsoft are registered trademarks and Windows is a trademark of Microsoft Corporation. FORTUNE 500 is a registered trademark of The Time Inc. Magazine Company. Dell disclaims proprietary interest in the marks and names of others. ©1993 Dell Computer Corporation. All rights reserved.

Our major competitors are so desperate to drop their prices to match ours, it makes you wonder what else they may be dropping.

Standards? Quality? Features?

Who knows?

We think you're better off with the i486 system you really want, at the price you really want.

We can give you the Dell® Dimension™ 486 series — as well as 386 and notebook systems — at lower prices without sacrificing features or quality. Because we deal directly with our customers, cutting out the middlemen our competitors use.

Each Dell Dimension system is manufactured to our exacting standards, and fully backed by the fastest-growing PC company in the FORTUNE 500.* Just like every one of the over half-million systems we shipped over the last twelve months.

So call Dell. Our prices may be low, but our computers aren't cheap.

DELL

800-241-5864

WHEN CALLING, PLEASE REFERENCE #11BDJ

HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN

IN CANADA, CALL 800/668-3021

SUMMARY OF FEATURES

Routers

The routers we tested fall into two categories: central routers, which can easily handle many simultaneous connections, and peripheral routers, which are suitable for sites with fewer connections. Since the speed of the connecting line, not the communications bus speed, is the main limit on speed for most peripheral routers, we give bus speeds only for the central routers.

In alphabetical order by company

■ = YES □ = NO

	Advanced Computer Communi-cations **ACS 4200**	PC EDITOR'S CHOICE Cisco Systems Inc. **Cisco AGS+/4**	PC EDITOR'S CHOICE Clearpoint Research Corp. **Constellation Pixis**	Hewlett-Packard Co. **HP Router ER**	PC EDITOR'S CHOICE IBM Corp. **IBM 6611 Network Processor 140**
Tested software version	5.1	9.1.1	3.1B4	5.74 05	1.0
List price (ZD Labs' tested configuration)	$6,500	$25,750	$7,745	$8,000	$13,095
Type	Peripheral	Central	Peripheral	Peripheral	Peripheral
LAN ports on ZD Labs' tested unit:					
Ethernet	2	2	4	2	4
FDDI	None	None	None	None	None
Token-Ring	2	1	None	None	4
WAN ports on ZD Labs' tested unit	3	1	1	2	4
Connection types available	Fractional T1, frame relay, PPP, RS-232, RS-449, T1, V.35, X.21, X.25	Frame relay, fractional T1, HDLC, ISDN, PPP, RS-232, RS-449, SDLC transport, SMDS, T1, V.35, X.21, X.25	X.25	Frame relay, fractional T1, ISDN, PPP, SMDS, T1	Frame relay, HDLC, PPP, SDLC transport, T1, X.25
Network Protocols Supported					
AppleTalk	■	■	□	■	■
CLNP (OSI)	□	■	□	□	□
DECnet Phase IV	■	■	□	■	■
IP	■	■	■	■	■
IPX	■	■	■	■	■
NetBIOS	□	■	□	□	■
SNA	□	■	□	■	■
Router terminates SNA traffic	N/A*	■	N/A*	□	■
Router passes SNA traffic via IP encapsulation	N/A*	■	N/A*	■	■
XNS	■	■	□	■	■
VINES	□	■	□	□	□
Routing Protocols Supported					
BGP	□	■	□	□	■
EGP	■	■	■	■	■
ES-to-IS	□	■	□	□	□
Integrated IS-to-IS	□	□	□	□	□
IS-to-IS	□	■	□	□	□
OSPF	■	■	□	■	■
RIP (IP)	■	■	■	■	■
RIP (IPX)	■	■	■	■	■
RTMP	■	■	□	■	□

N/A*—Not applicable The product does not have this feature

CONTINUES

	Network Systems Corp. **NSC 6607 Bridge-Router**	Novell Inc. **Novell Multi-Protocol Router**	Proteon Inc. **Proteon ProNet DNX-300m**	3Com Corp. **NETBuilder II**	Xyplex Inc. **Network 9000 Intra-Networking Hub**
	2.0	2.0	12.0	5.2	3.1B1
	$9,950	$2,490 (with NetWare WAN Links)	$4,995	$11,995	$9,635
	Peripheral	Peripheral	Peripheral	Central	Peripheral
	2	2	2	2	4
	None	None	None	1	None
	None	None	None	1	None
	2	None	None	1	6
	Frame relay, HDLC, PPP, X.25	Fractional T1, PPP, T1, X.25	HDLC, PPP, X.21	HDLC, PPP, X.25	HDLC, PPP, X.21
	■	■	■	■	■
	□	■	■	■	□
	■	□	■	■	■
	■	■	■	■	■
	■	■	■	■	■
	□	■	■	■	□
	□	□	■	□	□
	N/A*	N/A*	□	N/A*	N/A*
	N/A*	N/A*	■	N/A*	N/A*
	■	■	■	■	□
	□	□	■	■	□
	□	□	■	□	□
	■	□	■	■	■
	□	■	■	■	□
	□	■	■	■	□
	□	■	■	■	□
	□	□	■	■	■
	■	■	■	■	■
	■	■	■	■	■
	■	■	■	■	■

standard network protocols. It has a graceful Unix-like shutdown command, but it takes approximately three times as long to reboot as any other router.

IBM documentation is comprehensive beyond comprehension. The manual set includes everything: tutorials; in-depth networking and protocol descriptions; and detailed feature delineation by charts, tables, appendices, examples, and explanations. And nothing is left to chance: System capabilities and limitations for each mode of operation are documented in exacting detail. For good measure, the toll-free tech support number is printed in every manual. IBM's tech support and training teams are legendary, and their excellence continues for this product.

The 6611 is certainly not perfect; a number of management niceties are missing, and performance is merely average. But the 6611 has obviously been targeted by IBM first to conquer the SNA/SDLC internetworking world and then to move on to the open systems galaxy. And it is well-placed to do just that. For this reason, if you are presently in an IBM-centric shop, you must go and check out the IBM 6611, pretty face and all.

Network Systems Corp.

NSC 6607 Bridge-Router

BY GEORGE PORNARAS

Network Systems' 66xx-series of bridge-routers looks back to an earlier time. The fixed architecture, poor documentation, and arcane user interface of the tested 6607 unit mark it as a first-generation machine trying to hold market share in a field of more highly evolved competitors. And yet its sophisticated bridging and routing filters, full complement of protocols, and impressive array of network interfaces show that this router can't be entirely written off, especially for existing NSC or Vitalink shops.

NSC and Vitalink—the companies merged in 1992—both have a venerable presence in the bridge-router market. The 66xx-series routers boast an excellent suite of bridging and routing filters known collectively as Bridging and Routing Packet Control Facilities (BCF/PCF). The 6607 supports a large complement of

SUMMARY OF FEATURES

Products listed in alphabetical order ■ = YES □ = NO	Advanced Computer Communi-cations **ACS 4200**	Cisco Systems Inc. **Cisco AGS+/4**	Clearpoint Research Corp. **Constellation Pixis**	Hewlett-Packard Co **HP Router ER**	IBM Corp. **IBM 6611 Network Processor 140**	
Bridging						
Source-routing	■	■	□	■	■	
Source-routing transparent (SRT)	□	■	□	■	□	
Transparent	■	■	■	■	□	
Hardware Architecture						
Modular architecture	■	■	□	□	■	
Number and location of processors	1 on backplane	1 on backplane	1 on backplane	1 on backplane	1 on backplane, 1 on each processor module	
Processor type and speed	68030/25	68040/25	29005/16	68020/25	I960/25	
Communication-card slots offered	3	9	1	1	4	
Total RAM on tested unit	2MB	4MB	1.5MB	5MB	24MB	
On motherboard	2MB	4MB	1.5MB	5MB	16MB	
On processor boards	None	None	None	None	8MB	
Number of buses	1	2	1	1	1	
Bus speed	Line speed	533 Mbps, (CiscoBus)12 Mbps (system bus)	Line speed	Line speed	Line speed	
Fault Tolerance						
Hot-swappable modules	□	□	N/A***	N/A***	□	
Redundant power supplies	□	□	□	□	□	
SNMP Management						
Compliant with MIB-I	□	■	■	■	■	
Complaint with MIB-II (RFC 1213)	□	■	■	□	■	
MIB extensions:						
AppleTalk	□	■	□	□	□	
Border Gateway Protocol	□	■	□	□	□	
Bridge	□	■	■	□	□	
DECnet Phase IV	□	■	□	□	□	
DS1 interface	□	■	□	□	□	
DS3 interface	□	■	□	□	□	
Ethernet interface	□	■	■	□	■	
FDDI interface	□	■	■	□	□	
Generic	□	■	■	□	■	
OSPF, Version 2	□	■	□	□	■	
Token-Ring	□	■	□	□	■	

N/A**—Not applicable. This is a software product
N/A***—Not applicable. This product is not modular

ENDS

Network Systems Corp. **NSC 6607 Bridge-Router**	Novell Inc. **Novell Multi-Protocol Router**	Proteon Inc. **Proteon ProNet DNX-300m**	3Com Corp. **NETBuilder II**	Xyplex Inc. **Network 9000 Intra-Networking Hub**
☐	☐	■	■	☐
☐	☐	■	■	☐
■	☐	■	■	■
☐	N/A**	☐	■	■
1 on backplane	N/A**	1 on backplane	1 on backplane	2 on midplane, 1 on each processor module
29005/25	N/A**	80386/25	29005/25	68040/25
3	N/A**	2	8	5
2.5MB	N/A**	2.5MB	12MB	18MB
2.5MB	N/A**	None	12MB	16MB
None	N/A**	2.5MB	None	2MB
1	N/A**	None	1	1
Line speed	N/A**	Line speed	800 Mbps	Line speed
N/A***	N/A**	N/A***	■ (Communications modules only)	■
☐	N/A**	☐	☐	■
■	☐	■	■	■
■	☐	■	■	■
☐	■	☐	■	☐
☐	☐	☐	☐	☐
■	☐	☐	■	■
☐	☐	☐	■	■
☐	☐	☐	☐	☐
☐	☐	☐	☐	☐
■	■	☐	☐	■
☐	☐	■	☐	☐
■	☐	☐	☐	■
■	☐	■	■	■
☐	☐	☐	■	☐

routing protocols, including IP, IPX, AppleTalk II, DECnet IV, SR bridging, XNS, RIP, and PPP. Ethernet, 4-Mbps and 16-Mbps Token-Ring, T1, X.25, and FDDI networks are supported. And OSPF support is coming soon.

Probably the most important attribute of all is NSC's ownership of the 66xx series; there is always the hope that this router line, which originated with Vitalink, will eventually be brought up to the level of NSC's other products. The merger certainly has the potential to bring forth excellent products.

There are 18 routers in the 66xx series. The 6607 is a good choice for Ethernet networks; it has two Ethernet ports and one WAN port along with an AMD29005 single processor with 2.5MB of shared memory for buffer and protocol support. It had excellent IP routing and bridging performance, moving 90 percent of Ethernet's theoretical maximum. DECnet and IPX routing were good but far less impressive at 40 percent. Routing across 56-Kbps and T1 links proved

FACT FILE

NSC 6607 Bridge-Router

Network Systems Corp., 2001 Gateway Pl., # 700 West, San Jose, CA 95110; 408-452-8400; fax, 408-452-7631

List price: $9,950 (with two Ethernet ports and two WAN ports)

Requires: VT100 terminal emulator

In short: The 6607 Bridge-Router's Bridge/Packet Control Facility gives the WAN manger unequalled control over security and network traffic. However, the archaic interface, nonmodular architecture, and poor documentation tarnish the product. The 6607 needs reworking to be viable in this competitive market, but it's certainly not a hopeless case. NSC or Vitalink shops will want to pay close attention to this product's evolution.

505 ON READER SERVICE CARD

"Recommended."
Jerry Pournelle, Byte, July 1992

Inside Out

SupraFAXModem V32bis Internal
$349.95 Dos/Windows

SupraFAXModem V32bis External
$399.95 Stand Alone
$439.95 Dos/Windows

The Best Choice: SupraFAXModem

Inside or Out, now you can choose the hot-selling **SupraFAXModem** technology that best fits your computer. Either way, Supra can turn your PC into a communications powerhouse!

SupraFAXModems come in a wide range of models, from our budget-minded **SupraFAXModem** 24/96i to the fastest fax modem available: the **SupraFAXModem** V.32bis. Whichever model you choose, you will get Supra's proven technology and reputation for high-quality, reliable modems.

Supra modems are designed for novice and expert communicators alike. Whether you use DOS™, Windows™, or a Macintosh™, we've got a package for you — and our packages include everything you need. Plus our easy-to-follow Getting Started manuals will help you install your modem and start using it in just a few minutes! Imagine sending and receiving perfect faxes, exploring the world of on-line databases, or retrieving an important work file — all from the convenience of your desk. And advanced users will appreciate the error-correction and data-compression features that can save you money!

Supra Corporation

CIRCLE 183 ON READER SERVICE CARD

MODEL	INT./EXT.	FAX	DATA	V.42bis & MNP 5	MAX THROUGHPUT
FAX					
SupraFAXModem V.32	E	9600 S/R	9600	yes	38,400
FAX					
SupraFAXModem 24/96i	I	9600 S/4800R	2400	w/software	9600
DOS Package			• Windows Package		

No matter what your needs, a Supra modem is your best choice. Call us today at **1-800-727-8417**, and find out why!

Rockwell Modem Technology

CALLER ID AVAILABLE NOW

5 YEAR QUALITY GUARANTEE

All trademarks belong to their respective companies. 7101 Supra Drive S.W., Albany, OR 97321 USA • 503-967-2410 • Fax 503-967-2401

excellent for IP. Bridging across 56Kbps and T1 was also good at 75 and 80 percent, respectively. Latency was very low.

But getting the 6607's excellent performance is extremely difficult due to a poorly designed interface. Configuration is hampered by wretched documentation, and the main tool for creating and modifying the configuration files resembles the "ed" editor of early Unix. Worse, when you've finally finished editing and compiling your configuration, the *.CFG files are binary-unreadable, making them unviewable. A rudimentary quick configuration may be done using INIT commands, but this is poorly documented.

HIDDEN TREASURES

Like many other aspects of the 6607, the rudiments of good internetwork management are present but are not yet fully realized. Support of SNMP, in particular, suffers from the incomplete technical merger of the two companies. The product has a great deal of MIB II support, but there's no information on it in the documentation. Subprotocol options, such as SAP filters for IPX and interprotocol prioritization, are lacking. Fault monitoring is also outdated; there is no trace tool, and output from the debugger must be sent to NSC for analysis.

But experience counts, and only Proteon rivals NSC for experience and market influence. That is most evident in the richness of the 6600's bridging and IP packet routing filtration. These state-of-the-art systems are the culmination of years of combined bridging and IP routing experience. The Bridge Control Facility is an extensive filtering system that provides power and flexibility in establishing host zones of influence (domains) utilizing just the MAC-level address of the originating and target systems. These domains establish security and data-integrity nets around groups of hosts, as well as bidirectional controls on traffic moving to and from the hosts.

The elegance of NSC's high-level filtering becomes apparent when employing the 6607's IP Packet Control Facility. No fewer than five levels of filtering are available—two filters each for both the input and output interfaces and another that is internal to IP itself. The potential combination of filters allows network administrators to restrict routing processes even by type of application. Thousands of rule-specified processes can be restricted or allowed via the PCF. A powerful and indispensable tool for security, integrity, and bandwidth management, the PCF is a refined and mature filtering system, unsurpassed in the industry.

TROUBLES

The many features of the NSC 6607 are obscured by poor documentation. Errors abound; such blunders as missing commands in sample software configuration files, incorrect statements, and poor cross-referencing to vital information make configuration setup a hazardous proposition and make relying on the documentation a waste of time. Context-sensitive help is rudimentary; typing a question mark (or two consecutive question marks) supplies some information, but truly useful information such as default parameters and key-word information is not available.

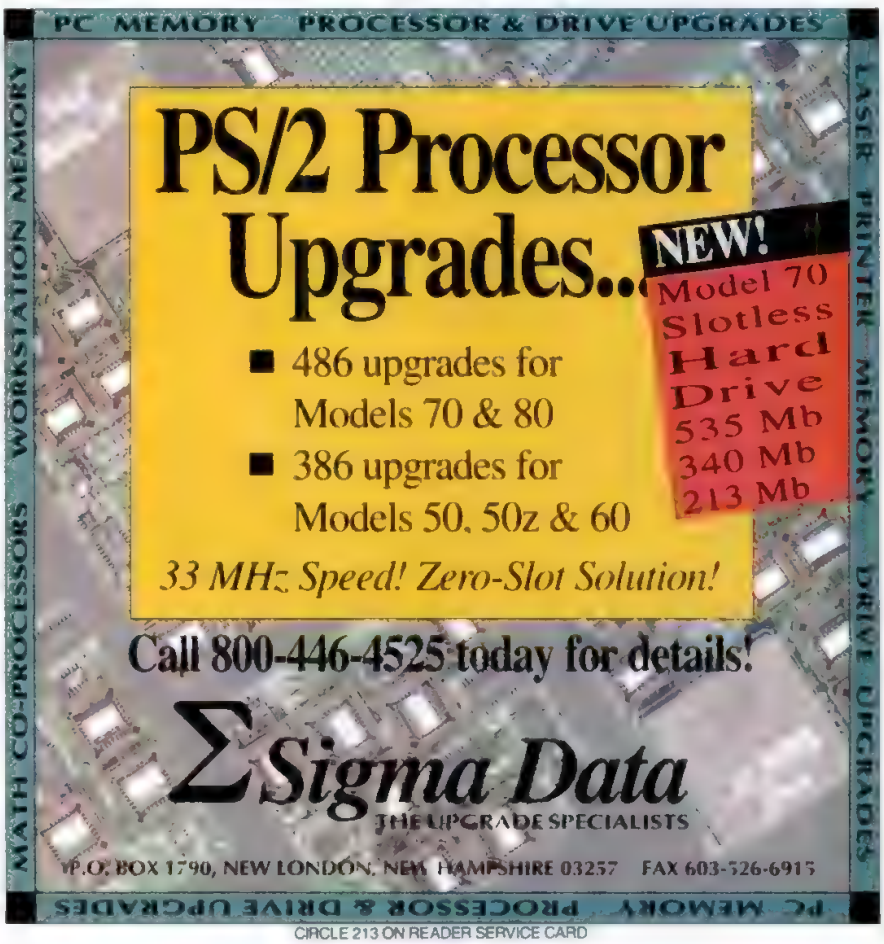
But once again, the well-established organization behind the product compensates, at least in part, for these shortcomings. NSC's large and well-trained cadre of engineers and service personnel provides technical support for users.

With NSC's guidance and development, the 66xx series may yet feature a viable product. The filtering capabilities and wide range of supported protocols and network interfaces serve as a reminder that NSC is a company to be reckoned with, but the 66xx series does not advance its reputation. Shops already using NSC or Vitalink products may wish to look this router over, but most others should hold out for its inevitable revamping.

SUITABILITY TO TASK

NSC 6607 Bridge-Router

	Poor	Fair	Good	Excellent
Flexibility	●	●	●	○
Documentation and support	●	●	●	○
Basic configuration	●	●	○	○
Advanced configuration	●	●	●	○
SNMP management	●	●	●	○
Console management	●	●	○	○



CIRCLE 213 ON READER SERVICE CARD

Novell Inc.

Novell MultiProtocol Router, Version 2.0

BY ROBERT LIPSCHUTZ

Is Novell trying to sell you the shirt off your back, sand in the desert, mud in March? After all, NetWare 3.11 already contains routing capabilities, and NetWare 4.0 promises more. You may ask why you need to buy the Novell MultiProtocol Router (MPR), Version 2.0, when NetWare 3.11 already contains a router. It's a good question, but Novell's expanded protocol and hardware support for the MPR makes for a good answer.

With the MPR, Novell has expanded the features of the device that comes with NetWare 3.11. The main differences include OSI and SNMP support, along with a new configuration menu. Otherwise, the router, which runs as a NetWare Loadable Module (NLM) on Runtime Novell, a one-user version of NetWare 3.11, is similar to the router contained in NetWare 3.11. The MPR is an obvious choice for Novell's IPX networks, though it would be out of place in IP environments. The product offers no support for DECnet Phase IV or, more important, for bridging. This means that unless packets can be routed, they cannot be passed. This limitation clearly emphasizes the recommendation above: If your network is primarily running NetWare traffic, the MPR is a great choice; but if the network must handle many other protocols as well, look elsewhere.

SUITABILITY TO TASK

Novell MultiProtocol Router

	POOR	FAIR	GOOD	EXCELLENT
Flexibility	●	●	●	○
Documentation and support	●	●	●	○
Basic configuration	●	●	●	○
Advanced configuration	●	○	○	○
SNMP management	●	●	○	○
Console management	●	●	●	●

If you have more than one network interface card in a NetWare 3.11 server, you have already used a Novell routing product. The MPR adds a few nice features: a great configuration utility, OSI and SNMP support, an enhanced SAP filter, and network protocol stacks. The router requires a 386 or 486 processor with 8MB of RAM, and Novell suggests using an Extended Industry Standard Architecture (EISA) or Micro Channel architecture (MCA) bus for high performance. Novell also recommends that you install the router on a dedicated PC, though it would be best to use a Novell-certified PC for this task. Because the device can use any ODI-compliant card, LocalTalk and ARCnet networks may join the group of LANs connected to the router.

PERFORMANCE

Performance may be increased by using Novell's PACKETBURST.NLM and LIPX.NLM. Although the PACKETBURST.NLM is not included in Version 2.0, it was available in Version 1.0 and

Introducing three new
You'll find the

Speed

Price

©1993 3Com Corp. 3Com, Networks That Go the Distance, EtherLink, LinkWatch, and Parallel Tasking are trademarks of 3Com Corp. Micro Channel is a registered trademark of International Business Machines Corp.

will be in NetWare 4.0. It lets IPX use a sliding-window acknowledgment scheme that improves performance, especially over wide-area links. This is especially important because IPX packets normally need an acknowledgment for each packet sent—a requirement that can really slow down communications.

The second file, LIPX.NLM, allows NetWare to send packets larger than 576 bytes to other networks. Because IPX cannot be fragmented, Novell normally sets the maximum packet size to 576 bytes, a size that Ethernet and Token-Ring can handle. With LIPX.NLM, the maximum packet size is 4K. Both PACKETBURST.NLM and LIPX.NLM are currently being rewritten by Novell to eliminate bugs.

INSTALLATION

The router installation follows standard NetWare procedures, but Novell has added a network configuration utility menu called INETCFG. This NLM supersedes the load and bind commands in AUTOEXEC.NCF. Choices made from menus are translated into the appropriate command line. You choose the network interface card you will be using and the network protocols you would like to bind to this card. The package then completes the configuration process. This utility also allows the manager to check the console log to view the messages given at start-up, thus easing the process of troubleshooting the router. INETCFG.NLM will also ship with NetWare 4.0.

Novell's MultiProtocol Router, Version 2.0, expands on the features of the router that comes with NetWare 3.11.

More advanced configuration is handled through the package's menu structure. Typically, the advanced features are listed together with with the basic features. Somewhat useful context-sensitive on-line help is available.

Filtering is good but uneven. For example, the unit does not support OSPF for IP, and has no AppleTalk, IP, or IPX traffic filtering non sequitur alert, at least without a transition. The device does have IPX SAP filtering, which allows the network administrator to determine which SAP devices may advertise their services across a router. You may also use the SAP filtering to restrict access to users or groups, much as the HP Router ER can group access. If, for instance, you want only your payroll department to have access to a remote server, create a group and give access to this group only.

MANAGEMENT

Novell claims that it offers full MIB-II support for its router, though we observed MIB-II support only for the systems, interfaces, and SNMP portions. This was accomplished through HP OpenView. Novell relies on the network interface card vendors to provide SNMP

Parallel Tasking adapters.
lines familiar.

Reaction

When we introduced EtherLink® III, the world's fastest Ethernet adapter, your response was equally quick: You bought it in record numbers.

Now EtherLink III's unique Parallel Tasking™ technology includes a 32-bit EISA and 16/32-bit Micro Channel® for twisted-pair, thin, or thick coax, and a 16-bit ISA combo with all three media on the same board.

You get the same pipelining design, the same software drivers, and the same automatic self-configuration that made EtherLink III a runaway success. Plus, complete SNMP manageability with LinkWatch.™ And like all 3Com® adapters, the new EtherLink III family comes with a lifetime warranty.

To learn more about this remarkable family of Ethernet adapters, and its surprisingly low price, call **1-800-NET-3Com.** Or see your nearest 3Com reseller. Because now there's even more to smile about.

3Com®

Networks That Go the Distance™

CIRCLE 293 ON READER SERVICE CARD

FACT FILE

EDITORS' CHOICE

Novell MultiProtocol Router, Version 2.0

Novell Inc., Internetworking Products Division, 2180 Fortune Dr., San Jose, CA 95131; 800-638-9273, 801-429-7000

List price: $2,490 (with Netware WAN Links)

Requires: 386- or 486-based PC, 8MB RAM, 40MB hard disk, high-density floppy drive, ODI-compatible network-interface cards certified for NetWare 3.11, DOS 3.1 or later, or DR-DOS 6.0 or later. NetWare WAN Links requires the Novell Synchronous/+ adapter board.

In short: The Novell MultiProtocol Router is essentially an enhanced runtime version of the routing program that is included in NetWare 3.11. It has the look and feel of the familiar network package. Novell has added a nifty configuration utility that takes the frustration out of installation. The router supports all network types, including ARCnet and LocalTalk, making it especially appropriate for moderate-size networks utilizing both PCs and Macintoshes. The router can be managed through standard interfaces, such as RCONSOLE, SNMP, and Telnet.

500 ON READER SERVICE CARD

support for the physical media.

All router management is done at the management console. Commands may be typed at the standard colon prompt, or NLMs may be used to access management tools. RCONSOLE, ACONSOLE, XCONSOLE, Telnet, and FTP may be used with the router. RCONSOLE allows a workstation on the network to access the router console. ACONSOLE allows modem access to the router console, while XCONSOLE gives a VT terminal-emulation mode or an X Window System interface the same access. Password protection is provided for RCONSOLE, ACONSOLE, and XCONSOLE sessions.

Several NLMs are available for network management, including INETCFG, MONITOR, TCPCON, and ATCON. INETCFG, as previously discussed, allows the configuration of the interface boards and protocol parameters. INETCFG also allows you to view console messages created as NetWare is loaded. These messages also supply useful information on the status of your configured system. NetWare users are familiar with MONITOR, which shows information about CPU utilization, memory usage, and network-interface-card statistics. TCPCON and ATCON provide TCP/IP and AppleTalk information, respectively.

Novell is working on a new routing protocol for IPX called NetWare Link Services Protocol (NLSP). Like OSPF, NLSP is a link-state protocol that generates much less traffic overhead on your network. NLSP will be available for Novell routers as an NLM, and specifications will also be made available to third-party routers.

Novell's documentation includes a single-page Quick Path Guide reference, which clearly shows all steps necessary for installation and configuration. In general, Novell has finely tuned its router to the needs of an all-NetWare shop. If your network mainly needs to route IPX, this is your router. If you have a multiprotocol environment that includes IP, you'll already be looking elsewhere.

Proteon Inc.

Proteon ProNet DNX-300m

BY ROBERT LIPSCHUTZ

Certainly, the Proteon ProNet DNX-300m's variety of supported protocols ensures a great deal of flexibility for small remote nets. It's one of the few available routers to support VINES networks, and SNA is also supported through IP encapsulation. It even makes allowances for routing any nonroutable protocol through its Adaptive Source Routing Transparent Bridging facility. And Proteon's excellent private MIB also enhances management capability. Best of all, it's inexpensive. But the unit is crippled by a poor management interface and unfriendly on-line help.

The high-end CNX-500 router, which has FDDI support and three communications slots, is the central router in Proteon's product line. The $4,995 Proteon ProNet DNX-300m that we tested has an 80386 processor with 2MB of main memory along with 512K of buffer RAM. The DNX-300m has room for only one communications card, which can have either two Ethernet ports and two Token-Ring ports, one Ethernet port and one Token-Ring port, or one LAN port with two WAN ports. All data moves directly to the CPU through a shared-memory bus. Proteon builds in an upgrade path by making these cards compatible with its Series 90 Intelligent Network Concentrator.

SUITABILITY TO TASK

Proteon ProNet DNX-300m

	POOR	FAIR	GOOD	EXCELLENT
Flexibility	●	●	●	●
Documentation and support	●	●	●	○
Basic configuration	●	●	●	●
Advanced configuration	●	●	○	○
SNMP management	●	●	●	●
Console management	●	●	●	○

The DNX-300m was an uneven but generally acceptable performer, passing packets at less than the recommended rate for IP, IPX, and bridging on Ethernet LANs. On the 56-Kbps WAN, IP was excellent and bridging was acceptable. Bridging degraded a bit when connecting to a T1 link, and IP routing was good, dropping from 100 percent on the 56-Kbps link to 80 percent on the T1 link. Token-Ring performance was slightly better for IP, routing 30 percent of Token-Ring's theoretical maximum. Source route bridging was also at 30 percent. IPX routing was poor at 10 percent of theoretical maximum. The performance on the Token-Ring network with the 56-Kbps link was perfect, since the routing moved 100 percent of the maximum Token-Ring frames on IP, IPX, and source route bridging. The T1 link performance dropped to 70 percent for IP and 60 percent for IPX and source route bridging.

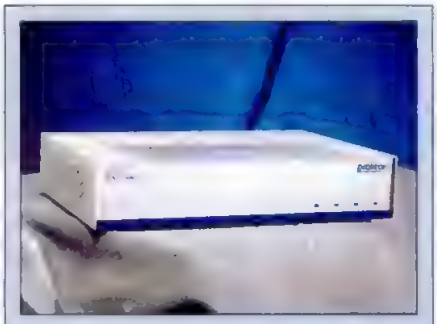
A few hardware niceties ease installation. The DNX-300m has both AUI and RJ-45 connectors, so transceivers are not

required for 10BaseT networks. The router automatically senses which connector type you are using. All ports on the router are well marked. Two lights indicate power and router traffic.

For our testing, we configured the DNX-300m to route AppleTalk, IP, and IPX over its two Ethernet ports. Proteon's Quick Configuration option eases installation for novices by walking them through the parameters required to get started. When selected, this option is automatically started the first time you boot the router, and it can be entered at any time by typing "qconfig" at a router command prompt. Unfortunately, AppleTalk is not included in the Quick Configuration setup screens, so a glimpse into the regular configuration screens is required.

The glimpse reveals the ugly side of the DNX-300m: the configuration editor's unintuitive command line interface. All advanced configuration requires the use of this configuration editor, which often uses long commands entered at a prompt. The editor allows you to communicate with the individual processes in the router. Help with command syntax, for example, is obtained by typing the command you would like to know more about, followed by a question mark. This shows only the acceptable arguments for the command.

The router supports what Proteon calls Adaptive Source Routing Transparent (ASRT) bridging. This will bridge all traffic that can't be routed. *Adaptive* means, in this case, that this bridging feature is backwardly compatible with older Proteon bridges that perform strictly source routing, or strictly transparent bridging. Proteon offers OSPF for IP, in case you're planning this move in the future. Extensive filtering may be done for IP and IPX, but no filtering is available for AppleTalk. The filtering command line interface is straightforward and flexible, allowing filtering by network number



FACT FILE

Proteon ProNet DNX-300m

Proteon Inc., Nine Technology Dr., Westborough, MA 01581; 800-545-7464, 508-898-2800; fax, 508-366-8901

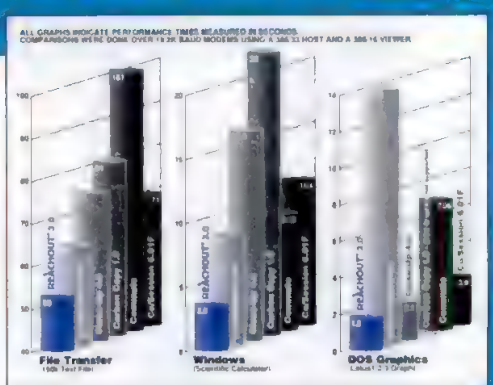
List price: $4,995 (with two Ethernet ports and 2 5MB RAM)

Requirements: None

In short: The Proteon ProNet DNX-300m allows three port connections, making it suitable only for small remote sites. It offers the VINES and SNA protocols as well as more common varieties. If you need to route VINES, the DNX 300m is one of the few solutions

506 ON READER SERVICE CARD

ReachOut Remote Control... nothing else compares!



Have you ever wondered why you haven't seen ReachOut mentioned in our competitor's ads?

Better performance. You can transfer files or run DOS and Windows based programs far faster than you could with any of our competitor's products. (Not something they would want to draw attention to, is it?). Your screen redraws are fast and your mouse responds instantly and accurately.

Greater flexibility. Take control over a phone line, a network or across dissimilar networks. You can work in a variety of environments and software compatibility is guaranteed so you'll always be able to rely on ReachOut to get the job done. ReachOut supports all popular modems, all popular networks and is the only program that directly supports Banyan Vines sockets.

More features. ReachOut was PC Magazine UK's Editor's Choice in August. They called ReachOut "the most complete remote control package available". ReachOut gives you DOS and Windows support in one package. State-of-the-art data compression, built-in virus protection and the best security features available anywhere, means a simpler, more cost effective remote control solution for you.

Products referenced are trademarks of their respective manufacturers

The Network Version is ideal for network administrators performing software distribution and trouble shooting and is invaluable for providing technical support in help-desk environments.

The modem version is ideal for home or laptop computing when you need access to remote resources, for remote technical support, product demonstration and joint problem solving.

Don't wait, order now and see why so many companies have chosen ReachOut as their Remote Control standard. We offer a competitive upgrade program and a 30-day, money-back guarantee.

Satisfaction Guaranteed! Call:
1-800-677-6232

Ocean Isle
SOFTWARE
49 Royal Palm Blvd, Vero Beach, Fl 32960
Phone. 407-770-4777, Fax 407-770-4779

PC MAGAZINE UK EDITORS CHOICE

REACHOUT REMOTE CONTROL
BOTH DOS AND WINDOWS SUPPORT IN ONE PACKAGE

CIRCLE 060 ON READER SERVICE CARD

Get a hold of the best value in LAN power protection

Now just $139!* *suggested list price

Blackouts, brownouts, sags... Your data and hardware are vulnerable to problems that surge suppressors and power directors are just not equipped to handle.

Now there's a complete Uninterruptible Power Supply solution to suit any budget. The Back-UPS™ 250 is reliable protection for LAN nodes, 386SX machines, 286, small PS/2 systems, and internetworking hardware such as routers, bridges, gateways and repeaters.

From the largest server to the smallest router, the Back-UPS Series will increase your productivity by providing a cost-effective solution to power problems. Call for your free power protection handbook.

The **Back-UPS 250** offers even more cost-effective protection for LAN nodes (typical runtime for a 386SX system is 10 minutes).

NEW!

Guaranteed ABSOLUTE™ *Protection*

- ABSOLUTE™ Protection guarantees repair or replacement of equipment (up to $25,000) if damaged by a surge while protected by a properly installed Back-UPS (See warranty for details)
- UL, CSA and Novell approved with a 2 year warranty
- Full-time surge protection and line filtering
- Most models include LAN interface for automatic-shutdown of Novell, LAN Manager, LAN Server, LANtastic, Banyan, SCO Unix, and others
- Ask about PowerChute® UPS monitoring software and Novell compatible UPS monitoring boards
- 230V models available

Model	Application	List	New List
Back-UPS 250	LAN nodes, 386SX, 286, internet hardware, POS	~~$169~~	$139
Back-UPS 400	Desktop 386, 486 systems, 286 servers	~~$249~~	$229
Back-UPS 450	Tower 386, 486 systems, servers	~~$329~~	$279
Back-UPS 600	Heavily configured systems, CAD/CAM workstations	~~$449~~	$399
Back-UPS 900	Multiple systems, longer runtime applications		$599
Back-UPS 1250	Multiple systems, LAN hubs, small minis, telecom equipment		$799

NEW!
NEW!

LAN Times Reader's Choice 1992

Computer Reseller News Editors' Choice

1991, 1990

The Back-UPS™

by American Power Conversion

(800)800-4APC, Dept. E4

APC 132 Fairgrounds Road, West Kingston, RI (401) 789-5735
APC Europe 111 (+33) 1 64 62 59 00 FAX: (+33) 1 60 17 80 29

Back-UPS, PowerChute, Guaranteed ABSOLUTE™ [illegible]

CIRCLE 162 ON READER SERVICE CARD

and socket range for IPX, and network/mask, protocol, and port for IP.

PRIVATELY MANAGED

The DNX-300m supports MIB II as well as a private MIB. The private MIB contains a programmable event logger and trap manager, which gives the network manager a powerful tool for network management, as well as such useful things as objects that will tell you what type of connector is on a serial port and the Internet address of the default gateway for the router. MIB II alone is not enough to manage a router fully, but Proteon's private MIB takes SNMP closer to being a viable management alternative. As with many private MIBs, the ASN-compliant ASCII file produced errors when compiled using HP OpenView. A few edits of the file allowed subsequent error-free compiling. Proteon said that it had not compiled the MIB using HP OpenView.

The DNX-300m may be managed through an attached computer running VT-100 emulation, a modem attached through the console port, or a Telnet session. Monitoring can be done through the router's console monitor. Typing "configuration" here shows which protocols are enabled and the state of each network port. Further information may be obtained by entering protocol-specific sections. Here, you may view packet statistics, ping or traceroute an IP station, view the routing tables, or view the interface addresses. No AppleTalk echo was available, and we were not able to view statistics by specific protocol; for example, the number of IPX packets serviced by the router since boot.

The two-manual documentation is mercifully indexed as one volume. In addition, quick-reference cards are provided for each protocol, but we found some irritating errors in the cards as well as in the master index. If the documentation doesn't help you, call Proteon's free technical phone support or take advantage of its free bulletin board access. Not everyone in its tech support group is a router expert, but you will normally get a call back the same day. For more in-depth support, Proteon has a variety of training programs and on-site contract options.

If all configuration tasks were performed through the quick configuration program, the DNX-300m would be an excellent choice for a remote site router. But the quick configuration program lacks AppleTalk, and the editor is incoherent and archaic. If that's no problem for you, the low price and Proteon's reputation may well justify the trouble.

3Com Corp.

NETBuilder II

BY ROBERT LIPSCHUTZ

3Com has the kind of hardware network gurus like. Hot-swappable communication boards, a modular management board, and multiple LED status lights give it much of the functionality of the Xyplex unit to which we gave an Honorable Mention. But 3Com's NETBuilder II has an unpleasant management interface and extremely difficult filter configuration. Improvement in those areas could lift this unit to the heights; for now, it's a solid but somewhat pricey choice.

The NETBuilder II, a central router, comes in two models, with four and eight communications slots. Its networking repertoire includes Ethernet, FDDI, and Token-Ring. Excellent protocol support gives the router flexibility, and planned SNA support and other IBM-centric features promise to expand that base. The combination of protocols and interface support makes the NETBuilder II a strong force in the router market.

This sort of power isn't cheap. We tested the 8-slot chassis, which along with the Communications Engine Card (CEC, a management module that houses the CPU and memory) costs $10,495. The software with X.25, frame relay, and SMDS support costs $1,500 more. Throw in interface cards at $1,125 for Ethernet, $2,995 for Token-Ring, $1,425 for WAN, and $7,500 for FDDI and you have everything you need. You'll struggle with the user interface, but no more than you would with almost any of the routers we saw. Price aside, the four-slot router is a good choice for a remote site, and the eight-port router a good choice to serve as your company's central router.

3Com, like Xyplex, uses customer-installable hot-swappable communications boards. The cards are not completely hot-swappable though; you must first disable the path through the management software, lest you erase its configuration. Additionally, only like boards may be swapped.

3Com uses the AMD 29000 RISC processor and Application Specific Integrated Circuits (ASICs). All slots are on one 800-Mbps bus with 12MB of RAM.

SUITABILITY TO TASK

NETBuilder II

	POOR	FAIR	GOOD	EXCELLENT
Flexibility	●	●	●	○
Documentation and support	●	●	●	○
Basic configuration	●	●	○	○
Advanced configuration	●	●	●	○
SNMP management	●	●	●	○
Console management	●	●	●	●

FACT FILE

NETBuilder II

3Com Corp., 5400 Bayfront Plaza, Santa Clara, CA 95052-8145; 800-638-3266, 408-764-5000; fax, 408-764-5001

List price: $11,995 (eight-slot chassis with software and CEC (Communications Engine Card). One-port Ethernet card, $1,125; one-port WAN card, $1,425; one-port Token-Ring card, $2,995; one-port FDDI card, $7,500. Four-slot chassis with software and CEC, $9,495

Requirements: None

In short: 3Com's hardware is unequaled, its powerful software includes support for all common network protocols including, by late 1993, SNA. However, an ungainly and poorly designed user interface tarnishes the package. This router is too expensive to be practical for a small, remote site, but it is highly recommended for larger sites, where its modularity and powerful features will certainly be utilized

587 ON READER SERVICE CARD

Firmware is loaded on Flash PROM on boot-up, and software is updated via disk. This is not as convenient as FTP downloads across a network would be, but it does beat using code on ROM chips, which must be removed for upgrading.

3Com ships the NETBuilder II chassis separately from its interface boards, which easily pop into their slots. The CEC also fits in a modular slot, making it easily upgradable. Any VT-100–compatible terminal attached to the console port serves as a configuration platform.

The NETBuilder II can be configured either through a command-line prompt or through 3Com's menuing system. Though both are difficult to use, the menuing system is somewhat easier, if unnecessarily convoluted. Menu choices are grouped illogically.

PERFORMANCE

As a central router, the NETBuilder II offers low latency and very good overall-performance. On the single stream Ethernet-to-Ethernet version of the Throughput test, the NETBuilder II routed DECnet, IP, and IPX packets at 99 percent of theoretical bandwidth. Bridging was equally impressive. OSI routing was lower at 36 percent of Ethernet's theoretical bandwidth.

With four streams, performance declined. Bridging and IP routing were still fine, however. DECnet and IPX performance was good; the NETBuilder II routed both protocols at 60 percent of theoretical bandwidth. OSI routing dropped to 30 percent of theoretical bandwidth. Latency for the NETBuilder II is low.

FDDI performance ranged only slightly. When routing IP, the device performed acceptably, handling 33 percent of Ethernet's theoretical bandwidth. Bridging was only slightly better, at 36 percent of theoretical bandwidth.

MANAGEMENT

3Com has added translation bridging for all protocols except AppleTalk. Although no bridge filtering exists, the NETBuilder II allows flexible (but complicated) router filtering for AppleTalk, IP, and IPX. The router has Classes of Service masks, which enable the router administrator to prioritize specified traffic, right down to the application level, over a WAN port.

3Com takes SNMP seriously, and its support allows thorough router control. 3Com supports all SNMP MIB II variables and markets its own SNMP management station, the ViewBuilder/UNIX, which runs under SunNet Manager. 3Com also supports OSPF and SMDS.

Management support is fully functional, either by protocol or by port. The router chassis even has a large collection of useful LED status lights for direct monitoring of its condition. Whether through a VT terminal, through a modem, or through a Telnet session, much of the 3Com console management may be done from the main prompt with show statements. Among other things, managers may get port-by-port reports on IPX packet routing, including information on packets received, forwarded, and discarded; they may also manage protocol configurations. The router supports ping, traceroutes, and AppleTalk pings. 3Com has a diagnostic port on its chassis, which allows a 3Com engineer to systematically look at your router when problems arise. 3Com claims that this port allows faster troubleshooting of software bugs.

LOOKING AHEAD

3Com recently introduced boundary routing, a software-implemented enhancement that, coupled with changes in network design, aims to make remote routers easier to configure and install. Boundary routing allows the central router to make complicated routing decisions. The remote routers function like bridges but with a bit more intelligence. With decision-making tasks transferred to the central router, remote-site router installation becomes easier.

3Com has announced a plan for adding support for IBM networks. The first stage, Token-Ring support, has already come to pass. SDLC conversion/tunneling and APPN support are slated to appear later this year.

The product comes with good documentation, but it lacks detailed information on such topics as protocols. It does provide a list of common acronyms. In case of trouble, tech support is available through a toll-free number, on CompuServe, and on 3Com's BBS.

3Com's router provides excellent hardware and powerful but poorly designed software. Its strong filtering is also obscured by its interface. With some modifications, the NETBuilder could be first-rate. Presently, it's a good central router, one that you should consider for your multiprotocol environment.

Xyplex Inc.

Network 9000 Intra-Networking Hub

BY GEORGE PORNARAS

Just when we were getting used to self-contained collapsed-backbone routers, Xyplex turns the market upside down with its Network 9000 Intra-Networking Hub. The Network 9000 uses a midplane architecture, giving it great configuration flexibility and lots of processing functionality; this architecture also provides the reliability and manageability users have come to expect from the fast, stable, inexpensive collapsed-backbone routers. Its stellar performance on our performance tests makes this product highly attractive to any multiprotocol shop.

The I/O cards are inserted into the midplane from the back, while the processor cards are inserted from the front. The unique midplane itself consists of

SUITABILITY TO TASK

Network 9000 Intra-Networking Hub

	POOR	FAIR	GOOD	EXCELLENT
Flexibility	●	●	●	○
Documentation and support	●	●	●	●
Basic configuration	●	●	●	○
Advanced configuration	●	●	●	●
SNMP management	●	●	●	●
Console management	●	●	●	○

three Ethernet, four Token-Ring, and two FDDI ports, each of which is an IEEE-standard bus. A tenth port houses the proprietary management bus, which allows the Network 9000 to use out-of-band management. This technique eliminates collisions between moving packets and internal router-management information. Out-of-band management usu-

SONY ENHANCED DATA GRADE D8. DESIGNED TO SAVE YOUR BUSINESS. NOT YOUR BIRTHDAYS.

D-Eight

The more information your business generates, the more you stand to lose. Because not all the 8mm tapes used by business are designed for business.

So before risking valuable data to a tape made for saving video memories, rely on new Sony Enhanced Data Grade D8.

This compact D8 cartridge starts out where our video grade leaves off, holding up to 5 gigabytes, for today's high-capacity storage and archiving. With data security features you'd only expect from the inventor of the 8mm video format.

For instance, new D8 has a more durable media for greater data integrity, taking over 1,500 full back-ups, to keep your business moving forward.

The shell is made to resist warping, while an improved lid reduces friction through over 10,000 openings and closings. The result is a shelf life that will exceed 30 years under recommended conditions. So your data will be around when you need it.

Since lost data can cost your business its lifeblood, trust yours to the safest place of all.

Sony Enhanced Data Grade D8. A memory worth celebrating.

SONY

SONY RECORDING MEDIA

1992 Sony Corp. of America. Sony and Data 8 Sony Recording Media are registered trademarks.

ONLY ON SONY RECORDING MEDIA

ally appears only in central routers; of the other products we saw for this story, only the Cisco AGS+/4 and DECnis had this feature.

The midplane is constructed to include ATM ports when I/O cards supporting that protocol become available. There are two routers available in the 9000 series: The 5-slot unit, which actually supports 5 I/O cards and 5 processor cards, can accommodate bridge-routing over 96 10BaseT or full 6-wire RS-232C terminal-to-server connections, or 20 bridge-router LAN or 20 T1/E1 V.35 WAN port connections, or some combination of these bridge-routing connections. The 14-slot model, which supports 28 cards, has potential for a phenomenal 312 ports for the terminal/host side and 56 ports for the LAN/WAN side.

The midplane architecture ensures that swapping I/O and bridge-routing configurations does not entail replacing your router's interface and board. And to support those configurations, the Network 9000 boasts a great deal of processor and memory power. Each slot can accept a Motorola 68040/25 processor card with 20MB of flash EEPROM and 16MB of static RAM. Additionally, the Network 9000 has the potential for added chassis RAM or an I/O-module ASIC processor through Motorola HC-11 processors. The midplane also accepts Xyplex's old MaxServer boards, thus making the product backward-compatible. Best of all, the modules are all hot-swappable and have automatic reconfiguration capabilities.

The Network 9000 is a strong Ethernet peripheral router, and its test performance was excellent. It bridged and routed 99 percent of the maximum number of DECnet packets. IP performance was slightly lower, at 85 percent, but both were still impressive. When connecting to 56-kilobit-per-second and T1 links, its performance was perfect, turning in 100 percent of the maximum number of IP packets. Bridging performance averaged 80 percent for the 56-Kbps link and 85 percent for the T1 link. Its latency was very low.

The Xyplex user interface is derived from the Digital world and shows a definite bias toward the VMS command line structure. On-line help is available by typing a command and a question mark. The interface will also give suggestions when commands are typed incorrectly.

The Network 9000 supports a fine selection of protocols, including IP, IPX, AppleTalk II, DECnet IV, RIP, EGP, PPP, X.25, HDLC, and frame relay. Many of the most important network interfaces such as Ethernet, V.35, RS-423, and X.21 are also supported. More seriously, although the buses support Token-Ring and FDDI, cards for those ports will not be available until later this year. The absence of those cards keeps this otherwise qualified package out of the central-router category.

All that heavy-duty hardware and protocol power is supported by feature-rich management and fault-tolerance capabilities, which add immeasurably to the manager's ability to monitor and maintain this unit. The unit has multiple layers of filtering, which range from complex bridge filters to separate AppleTalk, IP, and IPX filters and a three-level protocol priority queuing scheme to keep time-sensitive DECnet packet traffic moving. However, it has neither the BCF/PCF capabilities of the NSC 66*xx* series nor the "dial-on-demand routing" scheme from Cisco Systems.

The Network 9000 has redundant, SNMP-managed power supplies and fans, as well as auto-reconfiguration, features that are essential to transaction-based networking systems. With redundant SNMP monitoring, a defective power server will cause an SNMP alert without shutting down the entire router. The other devices will continue to operate and give system SNMP information. Additionally, the midplane's bus flexibility, which lets the user choose the processor-I/O route for transferring information on the midplane, adds reliability and fault-tolerance if configured redundantly.

MIB II is fully supported, as are the Kerberos security and authentication standards for SNMP. On-board Kerberos support, which we saw only in the Xyplex router, allows reliable and secure remote system management using industry-standard SNMP management stations such as Sun's SunNet Manager, IBM's NetView 6000, or Lexcel's Lance, for which Xyplex's ControlPoint management software modules were written. This is a truly fault-tolerant system.

The documentation is showing signs of the transition between the 9000 line and the earlier 6700 series, and stands in need of a thorough rewrite. The release note pages are starting to outnumber those of the original document, and contradiction and repetition are rampant. On the brighter side, Xyplex's warranty, which lasts three years, is the longest in the industry.

In some ways, this product seems almost too powerful to be a peripheral router; the Network 9000 provides the kind of performance and protocol support that approach central-router capabilities. Without OSPF and without Token-Ring and FDDI cards, it's not ready to be your central router, but you can buy the Network 9000 with confidence that you've chosen a dependable and excellent peripheral router. □

FACT FILE

Network 9000 Intra-Networking Hub

Xyplex Inc., 330 Codman Hill Rd., Boxborough, MA 01719-1708; 800-338-5316, 508-264-9900; fax, 508-264-9930

List price: $9,635

Requires: VT100 terminal emulator.

In short: The Network 9000 Intra-Networking Hub is the most modular, fault-tolerant bridging-router tested. All its components are managed by SNMP and are self-reconfiguring when replaced. The unit has numerous processor and I/O module slots and a full set of protocols. It can serve as either a 10BaseT or terminal server concentrator as well as a bridging/router. The Network 9000 is highly recommended for peripheral bridge-routing; only a lack of Token-Ring cards for this product keeps us from recommending it as a central router as well.

500 ON READER SERVICE CARD

DOS/WINDOWS MACINTOSH OS/2 UNIX VMS

KEYBOARD REMAPPER SCRIPT COMPILER TEKTRONIX 4105-4010 3179G TN3270 VT100-340

VT100-340 TN3270 3179G TEKTRONIX 4105-4010 SCRIPT COMPILER KEYBOARD REMAPPER

Faster than a speeding electron, more powerful than a massively parallel computer, able to leap across the largest network. It's PathWay Access. The most feature-rich, high-performance TCP/IP product for DOS/Windows, Macintosh and OS/2 computers. Simple to install and maintain, PathWay Access gives your users unmatched access to remote applications, printers and information. With the click

TCP/IP

PATHWAY ACCESS. LEAPS TALL NETWORKS IN A SINGLE BOUND.

TCP/IP

of a mouse, full-featured terminal emulations, keyboard remapping and scripting capabilities are at their command. And, PathWay Access coexists with all popular network operating systems. So, call us today for your 30-day free evaluation copy and let your users be superheroes, too.

1 ▲ 8 0 0 ▲ 8 7 2 ▲ 8 6 4 9

IN CALIFORNIA 1▲800▲962▲8649 OR 415▲962▲7202

FAX 415▲962▲0286 sales@twg.com IN EUROPE 322▲718▲0311

WOLLONGONG

STRAIGHT TALK. SOLID SOLUTIONS.

See us at Interop/Spring Booth #350

CIRCLE 103 ON READER SERVICE CARD

©1992 Wollongong All trademarks and tradenames are property of their respective holders

DOS/WINDOWS MACINTOSH OS/2 UNIX VMS

YOUR PC WILL RUN SO FAST, IT MAY BE SUBJECT TO A SPECIAL TEST.

Lots of accelerators run true color. Some also give you 1280 x 1024 resolution. The problem is they move about as fast as a slug on Valium. WIN.PRO is radically different. It has the fastest Windows performance in its class. Oh heck, why be modest. At this price, it has the fastest Windows performance in the world. Plus you get true color performance, VESA VL bus or ISA bus compatibility and 1280 x 1024 resolution. Look, we live in an accelerated culture. Don't leave your computer behind.

VIDEO SEVEN

CIRCLE 055 ON READER SERVICE CARD

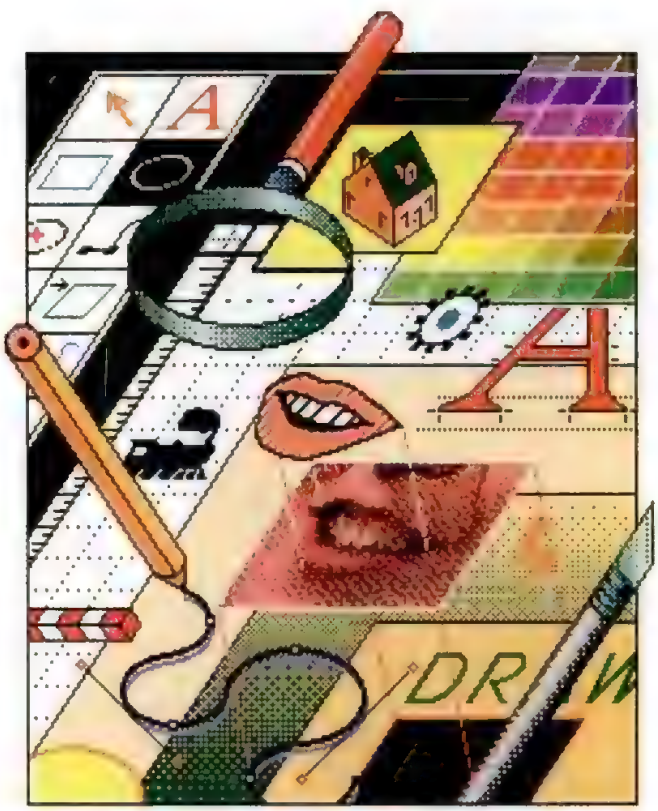
PROFESSIONAL ILLUSTRATION

In Pursuit of Truth *And* Beauty

Combine two or three packages into the toolset that meets all your needs.

For professional illustrators, one size does not fit all. From the technician detailing the inner workings of a hard disk to the artist depicting the beauty of an inner landscape, success or failure rides on the quality of the tools available. Accepting the limitations of your illustration tools—always an alternative and frequently a necessity—can hobble your creative vision.

Any single product may fill most of your design needs, but there are a variety of reasons why you might purchase a second—or even a third—package for occasional special-purpose tasks. A product such as Corel-



IN THIS REVIEW

Adobe Illustrator 280
Aldus FreeHand 282
Arts & Letters Graphics Editor 289
CorelDRAW 290
Designer 298
Professional Draw 303
Summary of Features 299

by James Karney

Illustration by John Craig

PC MAGAZINE

EDITORS' CHOICE

- **Adobe Illustrator**
- **CorelDRAW**

You can create attractive, high-quality illustrations with any of these professional illustration packages; thankfully, competitive street-pricing strategies have made it possible for you to stock your shelves with more than one product.

As Macintosh users have known for years, Adobe Illustrator ($695) is a fine product for artistic illustration; the program has excellent text handling, and its drawing tools are especially fluid. And if you require bulletproof PostScript printing and great screen-to-printer color matching, this is without question the product that you need. On the downside, Adobe Illustrator is hard to learn, and it has few built-in special effects.

CorelDRAW represents the flip side of Adobe Illustrator. Abundant special effects and a usable interface make this product a good artistic illustration tool; extras such as image-editing and charting utilities make this $595 package a great buy. Although you can certainly get good PostScript output from CorelDRAW, professionals who require more control over their output may hesitate over the program's inability to work with PPD's (PostScript printer description files) as well as its lack of calibration.

Aldus FreeHand ($595) deserves an honorable mention for its fluid drawing tools, including powerful pattern functions, excellent layer handling, and the ability to save object styles. The program's paragraph text and bitmap handling need some work, however.

Micrografx's Designer ($695) was and still remains a strong program for both technical and artistic illustration, but it needs updating; we look forward to the forthcoming release. Gold Disk's Professional Draw ($595) has some sophisticated technical illustration tools, but interface quirks and the inability to edit across layers hamper its usability.

The lack of drawing tools in Arts & Letters Graphics Editor ($695), from Computer Support Corp., deprives it of the flexibility necessary for professional work. The forthcoming update should do much to make this product competitive.

DRAW provides advanced tools for working with type and creating special effects. At the other end of the spectrum, Gold Disk's Professional Draw offers a broad range of object snaps and CAD-like ways to draw objects; for instance, it allows you to create an arc by specifying three points, the center plus two points, or the center, radius, and angle. Professional Draw takes more time and energy to master than most of the other products do, however. Thus, you might wish to create individual elements of an illustration in one product and bring them into another to complete the design.

The professional illustrators served by these packages aren't necessarily professional artists. They may only occasionally need to create sophisticated images—a quick color slide, a simple ad, a short brochure, or a certificate of appreciation—or may have decided to take advantage of a competitive upgrade in order to get a power tool at screwdriver prices. Furthermore, though it takes some time to learn all of a program's features, you don't have to be a master to perform basic tasks with any of these products. Most of these packages also offer clip-art and symbol libraries, which illustrators can use as a jumping off point for their drawings. Arts & Letters Graphics Editor, which can be used to create some very sophisticated and attractive illustrations, is nonetheless almost entirely symbol-based, and it lacks much in the way of traditional drawing tools.

Third-party clip-art libraries, such as those available from 3G Graphics (Edmonds, Washington; 206-774-3518) and a host of other companies, can also be used to augment your package's supply. When choosing a library, pick one that offers files in either the native format of your package—ArtRight offers its art in CorelDRAW's .CDR, for example—or editable EPS. Adobe Illustrator's .AI EPS format has considerable support and is probably the most robust choice for both clip art and file interchange between packages.

Similarly, a growing number of packages are supporting Micrografx's .DRW format. Some of these products, such as CorelDRAW and Designer, offer OLE support as well, which makes sense if your illustrations need frequent updating. And there's always the Windows Clipboard; you may lose important information when transferring complex graphics this way, however.

POWER TO THE PROS

Despite their diverse specialties, all professional illustration packages should still offer a common set of capabilities in order to facilitate the creation of complex drawings. These capabilities include advanced type handling and text handling—most important, support for nonproprietary scalable font formats such as TrueType or Type 1. Some form of object management—either the ability to lock and hide objects or the ability to place them on different layers—is essential for managing drawings with large numbers of objects. Support for 24-bit color mixing, for either spot or process color output, as well as the ability to import and export a variety of file formats (at the very least, EPS, .PCX, and TIFF), allows a program to produce high-quality images and to interact more efficiently with a variety of other applications, including desktop publishing packages.

Autotracing, included either as part of the package or in a separate utility, allows you to convert a bitmapped image into an editable, resolution-independent drawing. This capability is invaluable for

incorporating logos into electronic illustrations without having to re-create them. Finally, creating and editing Bezier curves is necessary for constructing sophisticated drawings.

All the products we evaluate here support these core functions; in addition, we only review products that have been upgraded since the last time we visited this category (the October 29, 1991, issue of *PC Magazine*)—or that received an Editors' Choice at that time (CorelDRAW and Designer). The packages—Adobe Illustrator, Aldus FreeHand, Computer Support Corp.'s Arts & Letters Graphics Editor, CorelDRAW, Gold Disk's Professional Draw, and Micrografx's Designer—are all solid performers, capable of producing full-color display ads, annual reports, technical drawings, and other complex projects. They offer sophisticated tools for editing Bezier curves, producing gradient fills, and defining exact colors. Coincidentally, they all run under Microsoft Windows.

The last year has seen many changes in both the quality of the existing products and the market itself. CorelDRAW has been significantly updated; it has an improved interface, better special effects, and enhanced color support. Gone are the old proprietary Corel fonts, replaced by 255 TrueType and Adobe Type 1 typefaces. In an attempt to become an all-in-one graphics utility, Version 3.0 is bundled with third-party paint, chart, and presentation software—all at a lower price. And the current version of Adobe Illustrator offers a huge improvement over the black-and-white–only version of the product we initially saw under Windows a few years ago.

Advanced tools for handling separations, such as trapping, gray-component replacement (GCR), and under-color removal (UCR), are also becoming more common. If you're doing high-end color work and your printer comes with a PPD (PostScript printer description) file—a device profile that helps you get optimal output quality—you probably want a program that can take advantage of it.

Several new players have also entered the high end. Gold Disk is trying to capture part of CorelDRAW's large mainstream user base by offering productivity-enhancing features such as stylesheets and a button-bar interface. At the same time, Professional Draw is also oriented toward Designer's more technically oriented users. Aldus Corp. has added Aldus FreeHand, which features Macintosh-like pop-up palettes and 99 levels of Undo, to its inventory.

Expect major upgrades, with interesting new features, from the leaders almost every 12 months. This spring will see another newcomer from the Mac, Canvas for Windows, an upgrade of Designer (see the sidebar "Let's Get Technical"), and a new version of Arts & Letters with drawing primitives. A new version of CorelDRAW is expected by summer.

Expect to see all of the packages reviewed here continue to copy features from each other and from low-end products.

THE RIGHT PACKAGE

Buying a high-end illustration program is not as straightforward as choosing a hard disk. You need to know what kind of work it must be able to do, what your skill level is (or how much effort you're willing to put into learning), and what kind of hardware you need to run it.

While all the products will work on a 386-based machine with a VGA board and Microsoft Windows, they all want more. If you are creating simple drawings or you are willing to put up with slow performance, the basic hardware will work.

For serious graphics, however, a 486-based PC with 8MB of RAM (16MB is even better), an accelerated Super VGA card with high-resolution drivers (for reviews of accelerated graphics adapters, see "Accelerators: Bringing Windows Up to Warp Speed" in the January 12, 1993, issue of *PC Magazine*), a 17-inch monitor, a permanent Windows swapfile, and at least a 120MB hard disk is recommended. Add to that a PostScript-compatible printer. If you plan on doing serious color work, a fast 24-bit graphics adapter is also advised but not required.

Another consideration for some is cross-platform compatibility. CorelDRAW and Designer offer both Windows and OS/2 versions (see the sidebar "Two for OS/2"). Users who work with Mac-based service bureaus may appreciate the fact that FreeHand and Illustrator offer native file formats that work on both platforms. Corel has indicated a Mac product is in the works, but no ship date has been given.

Of course, there are less high-powered options when it comes to choosing illustration software than the six products we tested. Some, like Micrografx's Windows Draw ($199) and Harvard Draw for Windows ($249), offer an easy-to-use product with a reduced feature set, although Harvard Draw's capabilities approach these professional packages'. If you hate Windows and don't mind using orphaned software—or think that $79.95 for a moderately powerful illustration package is too good a deal to pass up—check out KeyDraw! Plus, the current incarnation of Digital Research's Artline. (For more information about low-cost illustration products, see "Business Illustration: Art for the Masses" in the October 27, 1992, issue of *PC Magazine*.)

There's also a new category of illustration products designed specifically for nonartists and people who need to create diagrammatic illustrations such as flowcharts and organization charts. Aldus IntelliDRAW ($395), for example, has connecting lines that adjust when you move attached elements, the ability to set master objects (allowing users to make global changes), and a Symmetrigon tool that draws matching sides as you work. ShapeWare's Visio ($299; Seattle, Washington; 206-467-6723) works like an electronic stencil set. You drag and drop ob-

Our Contributors: GAYLE C. EHRENMAN is a staff editor of *PC Magazine*. LUISA SIMONE is a contributing editor to *PC Magazine*. JAMES KARNEY and PAUL MURPHY are frequent contributors to *PC Magazine*. DANIEL WILL-HARRIS is a freelance writer and graphics consultant. LORI GRUNIN was the associate editor in charge of this story, and JEFF MACE was the project leader.

Suitability to Task: Professional Illustration

You can create attractive illustrations with each of these packages, but that doesn't necessarily imply that the packages allow you to do so with equal ease. Each product has tools that make it suited for specific types of drawings.

In order to evaluate these illustration packages, each reviewer performed seven tasks. Three went into the creation of the mock ad for Joe's Pizza seen in the figure.

For the first step, our reviewers duplicated a photograph specifically designed to draw forth each package's strengths (see figure). For instance, creating the tablecloth allowed the reviewers to take advantage of such disparate types of tools as Designer's array capabilities and Aldus FreeHand's strong pattern handling. Similarly, simulating a wood grain in the window frame allowed Arts & Letters Graphics Editor's gradient-fill handling to shine.

The reviewers then designed a label, using the packages' text special-effects tools, to add to the drink bottle. Here, the availability of a warping tool allowed some of the reviewers to "wrap" the label around the bottle for a more realistic appearance. A TIFF image of a logo was imported and autotraced, using both the bitmap and vector versions on the page. The extremely thin lines, the intertwining of filled and unfilled spaces, and the almost-touching characters of the logo serve as a good test of an autotracer.

Finally, the reviewers imported and formatted several text blocks of varying lengths to test the packages' paragraph-text handling; they also entered various elements via the keyboard. They chose typefaces and other font attributes and used the packages' page layout tools to integrate each of the elements onto a single page.

This example of our artistic illustration test was created in Aldus FreeHand by Luisa Simone and printed on a Tektronix Phaser II PXi; the inset was generated as a transparency by MagiCorp.

The next two tasks evaluated the packages' technical-illustration capabilities. For the first exercise, the reviewers created a drawing similar to one you might produce with CAD software: a frontal view of a 3-inch gear. This allowed them to examine each package's ability to work with scale and exact dimensions, to create arrays, to convert text to curves, and to export in .DXF format. While Designer was the only package that could create a radial array, the reviewers found that reusable object styles helped to compensate in the other packages.

To test another type of technical illustration—charting and diagramming—the reviewers produced a relatively complex flowchart with hatch pattern fills, evaluating each of the products for ease of use; the intelligence of the symbol, object, and connector tools; and print quality.

To evaluate output and color quality, we printed the images on an HP DeskJet 500C, an HP LaserJet III, and a Tektronix Phaser II PXi (a color PostScript printer). We also exported the files in CGM, .DXF, and EPS formats. We analyzed the results for print speed, accuracy, color fidelity, and proper lines and fills.

Certain aspects of an illustration package are important regardless of the task. Important considerations for almost any task include the strength and breadth of the product's basic drawing, editing, and workspace management tools, as well as special effects and fills (such as skewing and gradient fills) that can be applied when drawing objects.

Similarly, ease of use and the quality of the package's documentation, tutorial, and on-line help can make a big difference in a user's productivity, regardless of the breadth of the package's feature set.

SUITABILITY TO TASK

Product Name

	POOR	FAIR	GOOD	EXCELLENT
Artistic illustration	●	○	○	○
Technical illustration	●	●	○	○
Color publishing	●	●	●	○
Color publishing	●	●	●	●

When it comes to specific types of tasks, however, products that behave quite dissimilarly can be equally effective. How you decide which package to use depends on the importance of various features to your illustration, your intended output device, and your illustration habits.

A product's suitability for **artistic illustration** depends on four key factors. First is the flexibility and fluidity of its illustration tools. The quality of its text and type handling is also important: Considerations include the flexibility of the program's text import and alignment options, its control over type specifications such as leading and kerning, the number of font choices it offers, and its ability to create special text effects. Special-effects options—such as extrusion, warping, blending, and perspective—can be powerful tools for expressing an artistic vision. Finally, sophisticated color mixing and palette handling are invaluable for creating a high-quality drawing.

Under **technical illustration,** we rate the package's suitability for precision illustration tasks. The ability to assign exact numeric measurements to elements, the flexibility of rulers, grids, and snap options, and the quality of layering and object controls are primary criteria. Strong duplication tools, such as rectangular and circular arrays, and the ability to save and reuse object attributes also come in handy when creating structured illustrations. We also take into account a program's features for importing CAD drawings (such as the ability to handle dimensioning, create element lists, and import .DXF files).

Under **color publishing,** we rate the program's suitability for producing printed color output of your illustrations. Considerations include the strength of its basic color models, its color PostScript support, and its ability to handle such printing-related tasks as registration marks, spot- and four-color separations, batch printing, and under-color removal.

"PC POWER" GET IT DELIVERED

There's only one Independent Guide to Personal Computing, and that's PC Magazine. From hardware and software to communications, graphics, programming, networking, and more, you get unmatched coverage of today's PC marketplace.

Subscribe now, and get 22 issues for only $29.97 — that's 54% off the $64.90 cover price. Better yet, sign up for two years and get 44 issues for just $49.97 — a savings of 62%!

Along with your order you'll also get PC Magazine's **"Utilities Disk Library"** on 3 disks — **FREE** with your paid subscription. These 103 utilities, selected especially for new subscribers by PC Magazine's editors, let you upgrade your system, boost your PC power, and simplify tasks — all at the touch of a key! Start your subscription today!

ONE YEAR
(22 issues) for $29.97.
YOU SAVE 54%!

TWO YEARS
(44 issues) for $49.97.
YOU SAVE 62%!

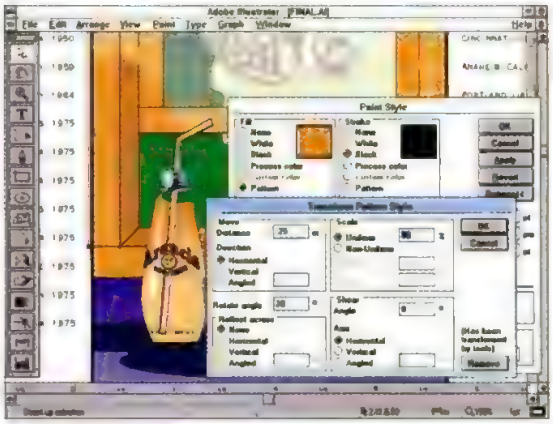
Call toll-free today:
1-800-289-0429

Basic one-year subscription $44.97; on newsstands $64.90. Canada and foreign add $32.00 per year. U.S. funds only. Canadian GST included. Please allow 30 days for shipment of first issue. FREE disks will be sent upon payment.

jects into place on the page from a palette of job-specific shapes. The objects and connecting lines are "intelligent"—move one and the rest will adjust automatically.

Expect to see all of the packages reviewed here continue to copy features from each other and from low-end products. Corel's "everything in one box" approach already has a low-end look-alike in the GraphicsWorks bundle from Micrografx ($295), which is based around Windows Draw. If the latest wave of upgrades suits your needs, it may be wise to give in to the temptation. You don't have to abandon an old favorite.

The competitive PC graphics market is good for users. We get better software at lower prices. The power offered by inexpensive 486s operating Windows and OS/2 gives developers a good platform for pushing their feature sets in an effort to gain advantage over their rivals. With all the competitive upgrade programs available, the cost of trying out a new top-of-the-line program is often less than $100 more than the street price of an entry-level application. That makes it easy to fit the right tool—or tools—to the job.



The complex patterns of the wood grain are just that—patterns that have been recolored and then rotated, moved, and scaled using Adobe Illustrator's pattern transformation functions.

Adobe Systems Inc.

Adobe Illustrator

BY LUISA SIMONE

Adobe Illustrator's virtues are not immediately apparent. This $695 illustration program doesn't offer fancy special effects. Nor is the program's interface, which primarily consists of 40 different toolbox functions, particularly easy to learn. Even basic features, such as gradient fills and automatic alignment functions, are mysteriously absent. And yet powerful Bezier editing tools, accurate screen previews, and efficient PostScript code make Illustrator a paragon among today's vector drawing programs.

SUITABILITY TO TASK

Adobe Illustrator

	POOR	FAIR	GOOD	EXCELLENT
Artistic illustration	●	●	●	○
Technical illustration	●	●	●	○
Color publishing	●	●	●	●

At first, Illustrator's jam-packed, flyout toolbox is intimidating. But nothing beats it for quick access to both drawing *and* editing tools. Creating the soft silhouette of the soda bottle for our test advertisement was as simple as drawing a rectangle and then inserting smooth curve nodes with the add-anchor-point tool.

In fact, creating all of the outlines for the basic drawing was downright easy, thanks to Illustrator's powerful tools, which all work with either click-and-drag interactivity or dialog-box precision. To create the concentric ellipses that form the plate, we used the centered oval dialog box. Instead of dragging outlines, we just clicked on a central alignment point and entered specific dimensions.

Of course, to complete this picture, we had to fill those outlines with colors and patterns. And here, Illustrator presents a mixed bag of functionality. You can create process colors using a CMYK, RGB, or HSL color model. Best of all, you'll find that Illustrator's process colors not only look good on-screen—they are actually accurate previews of the printed output.

Filling an object with a custom color or a pattern requires a little more work, however. Illustrator ships with 56 predefined patterns and the Pantone, Focoltone, TruMatch, and Toyo Ink color systems. But all of this information is stored in external document files. In order to access patterns or custom colors, you must keep these documents open as you work on your own drawing file.

Ultimately, this approach gives you more control over your working environment. For example, you can create your own custom color file that functions as a personal palette and contains only the hues you actually use. And Illustrator's insistence on storing patterns as vector drawings means that you can modify the patterns or create your own patterns easily. The complex wood grains of the window frame in our sample illustration are really two patterns that we recolored with woodlike tones and then rotated, moved, and scaled using Illustrator's pattern-transformation functions.

The program does not support true gradients; simulating gradients required that we draw a starting and an ending shape and then use the Blend tool to create transitional objects. This approach isn't as retro as it seems. It gives you a great deal of control over the number of shades (or objects) in a blend and therefore, the size of the resulting file. Increasing the number of transition steps results in a smoother blend, but it also means that you have to manage a larger number of objects.

PC MAGAZINE EDITORS' CHOICE

FACT FILE

Adobe Illustrator, Version 4.01

Adobe Systems Inc., 1585 Charleston Rd., Mountainview, CA 94039; 800-833-6687; fax, 415-961-4810

List price: $695.

Requires: 386SX-based PC or better, 4MB RAM (8MB recommended), 2.7MB hard disk space (12MB recommended), VGA display or better, DOS 3.3 or later, Microsoft Windows 3.x, mouse.

In short: A tough-to-learn interface and a lack of special effects and gradient fills make Adobe Illustrator, Version 4.01, ill-suited for novices and casual business users. Still, there is some real power here, including sophisticated Bezier editing, accurate screen previews, powerful drawing and editing tools, sophisticated text handling, and advanced masking and blending functions, which should be attractive to professional users.

467 ON READER SERVICE CARD

COREL DRAW!
The Graphics Super Star

ALL-IN-ONE PACKAGE!

"CorelDRAW has six graphics packages in one stunning Windows program. And these are not watered down versions—they compete feature for feature against stand alone products."

MVP

VERSATILE CHARTS and GRAPHS!

"CorelCHART is the easiest charting package I've ever used, thanks to its intuitive design, ease of object editing, and the smooth integration with the rest of Corel's products."

TOP 100 PC SOURCES

POWERFUL PHOTO-EDITING!

"Corel PHOTO-PAINT is in a class by itself; no other product can match its image editing powers for close to its price range."

PC WORLD WORLD CLASS AWARD

THOUSANDS OF CLIPART!

"Even if you only use a portion of the 256 fonts or 14,000 CD-ROM clipart images, you've likely recovered your investment."

INFOWORLD 1992

EASY TO USE!

PC MAGAZINE EDITORS' CHOICE

"CorelDRAW remains the easiest-to-use graphics product on the market...The ultimate graphics bargain!"

VALUE-PACKED!

1991 BYTE AWARD OF DISTINCTION

"CorelDRAW 3.0 for Windows delivers all the graphics applications you could ask for. The program's ease-of-use, coupled with its power, has users singing its praises."

DYNAMIC PRESENTATIONS!

COMPUTE CHOICE AWARDS

"CorelSHOW, an extremely simple presentation program that makes displaying charts and drawings a snap."

GREAT TEXT HANDLING!

PC WORLD BEST BUY

"CorelDRAW has what many other drawing packages lack: superb control over type...A sizzling best buy."

Suggested list price
$595

WINNER OF OVER
90
FIRST PLACE AWARDS

CorelDRAW has emerged as the ALL-IN-ONE graphics Super Star! Celebrated by top international industry publications, it has won over 90 awards for its exceptional ease of use, incredible value and outstanding features.

CorelDRAW 3.0 outshines the competition! There is no longer any need to buy separate illustration, charting, photo-editing and presentation software, because CorelDRAW 3.0 includes CorelCHART, Corel PHOTO-PAINT and CorelSHOW—all in one value-packed box.

CIRCLE 011 ON READER SERVICE CARD

CorelDRAW is Network Ready and MULTIPLATFORM for corporate standardization: Windows, OS/2, UNIX, CTOS. And soon available on the Mac and in 20 languages!

MICROSOFT WINDOWS COMPATIBLE

No wonder CorelDRAW is the world's best selling graphics package!

1-800-836-DRAW
CDN TEL: (613) 728-8200 / FAX: (613) 761-9176

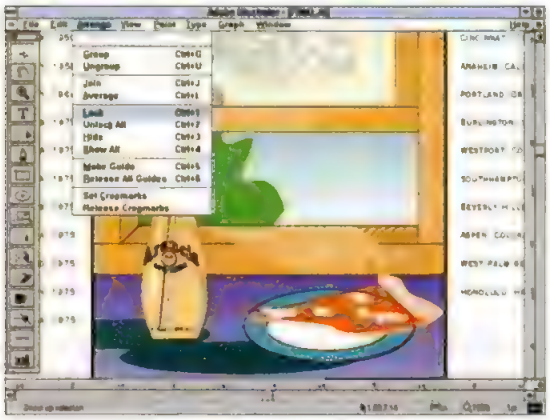
COREL

KUR-0012

COMPLEX PROBLEMS

Illustrator lacks automated alignment functions and robust object management functions. So dealing with a complex drawing that contains lots of objects can be a real chore. Illustrator can create an infinite number of nested groups and lock and hide objects. But selecting objects—even in wireframe mode—is a nightmare if your drawing contains numerous complex blended objects.

During testing, we discovered not just the power but also the great flexibility of Adobe Illustrator's internal tools and ancillary programs. For example, in the technical illustration, we aligned the teeth of a gear to a 3-inch circle by first drawing the circle and then converting it to a guideline. Illustrator can convert any object into a guide—making it easy to align objects to curved or irregular shapes. The rotation dialog box and step-and-repeat functions made it possible to copy, rotate, and position the gear teeth. And while Illustrator does not contain any associative dimensioning functions, its measurement tool allowed us to determine the true length of the hand-drawn dimension line and then enter the value manually.



Adobe Illustrator's Direct-up arrow tool allows you to select and modify an individual outline (such as the plate shown here) that is also part of a larger grouped object.

Finalizing the layout for the pizza ad was a breeze. Illustrator can wrap text around objects, align text to an irregular path, and even flow text within linked outlines. The paragraph-alignment functions, combined with the kerning and tracking capabilities, made short work of copy fitting and formatting the text. And if you use Illustrator's 18- by 18-inch pasteboard economically, you can even create spreads or multipage documents.

Illustrator relies on several bundled ancillary programs for essential functions. The package supports only Type 1 fonts (TrueType will be supported in a future version) and requires Adobe Type Manager. If you want to warp an entire word or text phrase by manipulating the object's bounding box, you must use Adobe TypeAlign, because Illustrator does not offer warping functions.

Interestingly, Illustrator's built-in tracing functions did a fine job of producing a clean vector outline from our sample bitmapped logo. But if you trace more complex images, you'll appreciate Adobe Streamline, which can trace color photographs and recognize line patterns and is free to registered Illustrator users.

The fourth ancillary program that ships with Illustrator, Adobe Separator, can turn your Illustrator files into four-color film separations. Among other capabilities, it offers dot-gain compensation and optimized line frequencies.

During testing, we were impressed with both the speed and accuracy with which Illustrator prints. Printouts from our color PostScript printer (a Tektronix Phaser II PXi) exactly matched the screen display. Indeed, the promise of bulletproof PostScript output is one of Illustrator's main selling points.

In the final analysis, Illustrator's lack of special effects makes it less than suitable for casual business users. Its advanced functions, such as masking and blending, are not geared to novices. But, if your design skills make special effects superfluous, you'll find Illustrator's drawing tools to be both powerful and fluid.

Aldus Corp.

Aldus FreeHand

BY LUISA SIMONE

It's easy—too easy—to define Aldus FreeHand only in terms of what the program lacks. This $595 program boasts no special effects such as warping or perspective à la CorelDRAW. Nor does it offer ancillary programs such as the tracing or separation utilities that ship with Adobe Illustrator. But FreeHand delivers a strong set of drawing tools that rival CorelDRAW for ease of use. The PageMaker-like palettes and streamlined menu structure make FreeHand a program that even business users can master.

FreeHand's seemingly Spartan menu structure belies the real sophistication of the program, where commands often serve double—or even triple—duty. For example, you need know only one command—Join Elements—to connect the end nodes of two different paths or to align text to a curve. FreeHand automatically determines the most appropriate action based on the types of elements you've selected. So if you select a text string and a path, FreeHand aligns the type to the curve. Alternatively, if you se-

SUITABILITY TO TASK

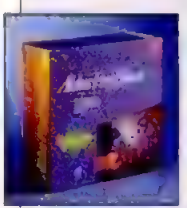
Aldus FreeHand

	POOR	FAIR	GOOD	EXCELLENT
Artistic illustration	●	●	●	○
Technical illustration	●	●	●	○
Color publishing	●	●	●	●

FACT FILE

Aldus FreeHand, Version 3.1

Aldus Corp., 411 First Ave. South, Seattle, WA 98104-2871; 206-628-2320; fax, 206-343-3360



List price: $595

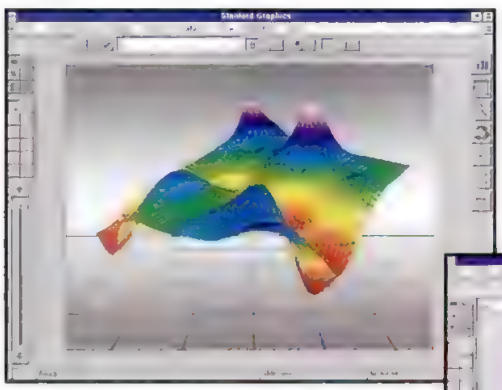
Requires: 286-based PC or better, 2MB RAM (4MB recommended), 5MB hard disk space (16MB recommended), EGA display or better, DOS 3.3 or later, Microsoft Windows 3.x, mouse.

In short: Aldus Corp.'s Aldus FreeHand, Version 3.1, is not the program you should buy if you are looking for an all-in-one solution to your illustration needs. But professional artists will appreciate Aldus FreeHand's masking and patterning functions and strong set of drawing tools, and business users will find that the PageMaker-like palettes and streamlined menu structure make it one of the easiest programs to learn and to use.

ON READER SERVICE CARD

Stanford Graphics 2.1. Power Graphing!

In the "real world," communicating your analysis requires more than a pretty picture. Consider Stanford Graphics for Windows for your serious presentations. It delivers the best of both worlds: presentation *and* analysis. Now you can have everything you need to create high-impact presentations without sacrificing number-crunching muscle. And, you won't need a Master's degree to use it either! Stanford Graphics' Quick Start options will have you up and running in minutes. So you'll be able to concentrate on your message, and not the method. Even data analysis and tinkering are a breeze. Just click on a point to change its value; pull a lever to adjust a formula. So don't wait another nano-second. Call right now for a free Demo Disk that will unleash the power of Stanford Graphics.



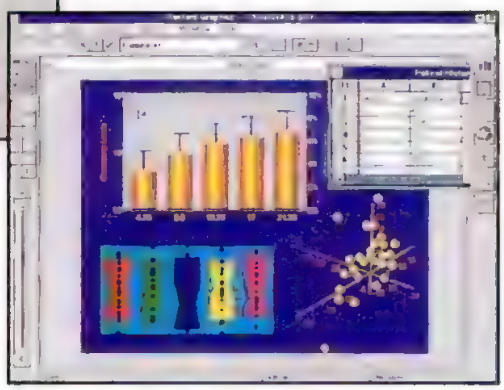
Tap into powerful auto-processing graphs to transform raw data into stunning presentations.

"Stanford is a breakthrough product that combines technical charting, data analysis, and presentation tools. Basically, it's fabulous."

– PC Magazine
March 1992

"When it comes to charting power, data analysis and sheer brute strength, nothing comes close to Stanford Graphics."

Windows Magazine
November 1992



Find the meaning behind your data with advanced statistical graphs and functions, including Student t-tests & multiple regression analysis.

See your data in ways you've never dreamed possible with the Gallery of over 165 business, statistical & technical graphs.

Free Demo!

Form *and* Substance. Presentation simplicity *and* technical sophistication. Finally…presentation graphics with numerical clout!

3D 3-D VISIONS
2780 Skypark Drive • Torrance, CA 90505
Tel: 310-325-1339 • Fax: 310-325-1505

Call Toll Free Today.
1-800-729-4723

The development, maintenance, and implementation of this product have no connection with Stanford University. * Reprinted with permission, March 17, 1992, © 1992 Ziff Communications Co

CIRCLE 094 ON READER SERVICE CARD

And for good reason. Because CompuAdd Express is the only one that can bring you everything you ever wanted in a color notebook–for just $2,795. And we mean everything. Because the Express 425Color has a 25MHz 486 processor, built-in trackball, built-in fax/modem, 8MB RAM, 120MB hard drive, and a passive matrix, 640x480 resolution display. So your graphics pop, Windows icons and command boxes will be easier to use and all your applications will be more enjoyable. Plus, you can take advantage of simultaneous display capability for more effective presentations. All for just $2,795.

You also get our exclusive **Remote Rescue** online technical support. If you have a problem, our Technical Support staff can use Remote Rescue to dial up your system, diagnose hardware and set up problems and properly configure your system for you. Remote Rescue uses Close-Up 4.0, the award-winning remote communications software, to provide technical support you can't afford to be without.

We Think We Just Heard A Collective Groan From Our Competition.

How can we do it? Because at CompuAdd Express, we focus our energy on our customers and their needs. And you can buy from us with confidence, because we're a spin-off of CompuAdd, the company that pioneered direct marketing of computers 10 years ago.

With this impressive combination of technology, engineering, service, commitment and low price, it's no wonder our competition is groaning. And no wonder our phones are ringing. Because when you're looking for the best value, it all adds up to CompuAdd Express. **Just call 1-800-925-7811 today.**

Standard With Every CompuAdd Express System:

** Remote Rescue online technical support*
** 30-day money back guarantee*
** Express 30-day exchange*
** One-year limited warranty covering replacement or repair of defective hardware*
** Rapid repairs*
** Toll-free technical support*
** Technical bulletin board service*
** The convenience of Express Leasing*
** Easy credit when you have an Express credit card*

MICROSOFT® WINDOWS™ READY TO RUN

We accept MasterCard, VISA, CompuAdd Express Charge, money orders, certified checks (please allow ten days for processing), CODs (minimum order $50), company and institutional purchase orders (minimum initial purchase $250, thereafter $50 with approved credit) and wire transfers. Shipping charges are calculated according to weight and distance. Texas residents, please add appropriate local sales tax. CompuAdd Express will replace or repair defective hardware, software and consumable items. A 15 percent restocking fee may be charged. All returned items must be accompanied by a return

Express 425Color Notebook

$2,795

Lease for only $103/mo.

Cyrix CX486SLC processor rated at 25MHz.

120MB hard drive.

Presentations are easy with the 425Color's simultaneous display. Use the external VGA video connector to display data and graphics on your notebook and a full size monitor at the same time.

Passive matrix LCD display with 640x480 resolution. Measures 8.5" diagonally.

Built-in 9600 baud fax/2400 baud modem, both with send/receive capability.

Easy to use built-in mouse trackball.

The total system weighs only 6.3 pounds–including battery.

Click buttons are on the side.

Measures 8.5" x 11.5" x 2". Chassis has a suede texture finish.

Math coprocessor built-in.

84-key layout implements the functions of a standard 101-key keyboard.

Automatic virus protection.

Up to two hours of battery life (depending on application, individual use and power management).

FREE LotusWorks 3.0

Charge batteries in notebook or in our optional battery charger (charges two batteries).

The 425Color warns you two ways when its battery is low–with a beep and a blinking light.

8MB of RAM expandable to 20MB.

FREE Windows 3.1, MS DOS 5.0, LotusWorks 3.0, Close-Up 4.0, international adapter and carrying case–OVER $600 VALUE!

Display controls are beside the screen on the right.

Standby buttons shuts down display and drives when you close the lid but preserves data.

Power switch located on the keyboard surface.

The inverted "T" configuration for arrow keys is conveniently located.

A 1.44MB 3.5" internal floppy drive makes transferring data easy.

REMOTE RESCUE: **Our Exclusive Online Technical Support.** It's technical support you can't afford to be without–support that's quicker and more effective than ever, because we can actually solve your problems online. Remote Rescue uses Close-Up 4.0, the award-winning remote communications software program that lets our Technical Support staff dial up your system, diagnose hardware and set-up problems and properly configure your system for you. And the software is preinstalled FREE on every CompuAdd Express system.

Express 425XL Notebook

64 Grayscale

- Cyrix CX486SLC processor rated at 25MHz
- Up to 3 hours of battery life (depending on application, individual use and power management)
- Math coprocessor socket in drawer for easy access
- Super-twist backlit liquid crystal display
- Display: 9.5" usable diagonally
- 64 levels of grayscale
- 9600 baud fax/2400 baud modem; FREE Bit-Fax software
- 120MB IDE hard drive
- 1.44MB 3.5" internal floppy drive
- 4MB RAM expandable to 20MB
- Built-in mouse trackball
- Serial and parallel port, PS/2 keyboard connector
- External VGA video connector for simultaneous display
- Only 6.3 pounds including battery
- FREE Windows 3.1, MS DOS 5.0, LotusWorks 3.0, Close-Up 4.0, a free international adapter and carrying case–OVER $600 VALUE!

$1,995

Lease for only $73/mo.

Call to order, for other configurations or to request a free catalog.

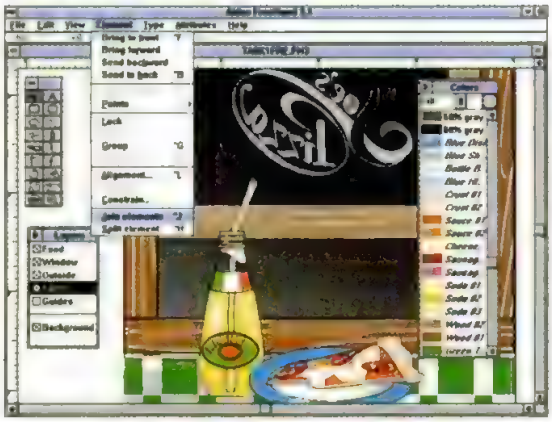
CompuAdd Express

800-925-7811

12301 Technology Boulevard, Austin, Texas 78727
Hours: 8am-8pm (CST) M-F
512-219-1800 Fax 512-219-2890

merchandise authorization (RMA) number. CompuAdd Express sells and services equipment within the United States only and will pay no customs, duties or tariffs on returned merchandise. Prices and product descriptions are subject to change without notice. CompuAdd Express is not liable for damage due to omissions or typographical errors. A copy of our limited warranty is available prior to sale from your sales representative. MS DOS 5.0, Windows 3.1, LotusWorks 3.0 and Close-Up 4.0 are OEM versions.

CIRCLE 128 ON READER SERVICE CARD



In our sample drawing, we used Aldus FreeHand's Join Elements command to create compound objects, connect the nodes of Bezier curves, and align text to a curved path.

lect two open paths (and the end nodes are within snapping distance), FreeHand connects the endpoints to create one path.

We took advantage of FreeHand's masking and custom pattern functions quite a bit during testing. Creating a clipping path (or mask) was the easiest way to clean up the edges of the pizza slice. And repeating pattern tiles made short work of the tablecloth and the wood grain of the window frame. Whatever you copy to the clipboard is available to be pasted into a mask or used as a pattern tile.

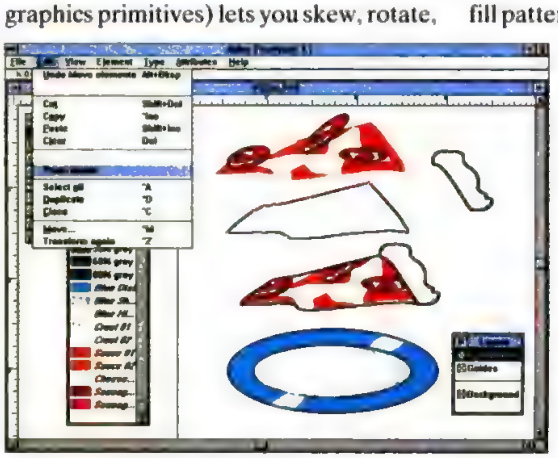
All this talk about a simple interface may surprise those users who have tried FreeHand and been intimidated by the complex toolbox and in-your-face drawing paradigm. But once you understand that FreeHand's free-form and Bezier tools create paths—not objects—you can learn this program. Objects created with the rectangle, rounded rectangle, ellipse, and line tools display the familiar Windows handles and can be resized interactively. Paths are in a form suitable for node editing. This, along with the powerful smooth, corner, and connector tools, allows you to modify outlines efficiently. To treat a path like an object, you must group it; to treat an object like a path, you must ungroup it.

FreeHand's functions aren't merely easy to use; they are also intelligently implemented. For example, during the creation of blends or the alignment of text to a path, the relationship between the elements remains dynamic. So it is possible to subselect an element, edit the shapes, and have FreeHand automatically recalculate the effect.

Even when our tests exceeded FreeHand's capabilities, the program's inherent flexibility allowed us to circumvent the problem. For example, FreeHand's built-in autotracing tool ran out of memory when we tried to trace the entire test logo. Tracing at a lower resolution yielded unsatisfactory results. But tracing only half of the logo and then manually editing the two halves together yielded an extremely accurate trace.

FreeHand gives you a host of different tools with which to manage a complex drawing. With up to 99 levels of undo, creating a FreeHand drawing is almost goofproof. And you can protect your drawing from inadvertent changes with grouping, locking, and layering functions. Simplifying the workspace is as simple as toggling the display of a layer off or dragging a layer to a new position in the Layers palette.

Creating headline or logo text is especially easy with FreeHand's tools. We used the text formatting effects to generate automatic shadows for the display type in our sample ad. Other effects include oblique, outlines only, and zoom (a simulated 3-D effect). FreeHand also produces consistently good results when you are aligning text to a curved path. The Element Info dialog box (which is also used to modify free-form shapes and graphics primitives) lets you skew, rotate, or maintain the vertical orientation of the text aligned along a path.



The unruly ingredients (such as the sausage rounds) are neatly trimmed when the outline of a pizza slice is used as a clipping path with Aldus FreeHand's Paste Inside command.

MINIMALIST TEXT HANDLING

Unfortunately, the news concerning FreeHand's text capabilities isn't all rosy. FreeHand does not supply warping or perspective functions of any kind; so creating a label that wrapped around the soda bottle was old-fashioned hard work. The program ships with Adobe Type Manager and only 13 Type 1 fonts. In addition, creating a text layout was made more difficult by FreeHand's lack of text import filters, automatic text wraps, and paragraph level formats such as indents or tabs. Most distressing is FreeHand's current level of support for TrueType fonts, which cannot be printed to a PostScript device unless converted to curves.

Aldus FreeHand's seemingly Spartan menu structure belies the real sophistication of this illustration program.

FreeHand's Styles and Colors palettes are particularly suited to highly formatted drawings, such as the flowchart that was part of our test suite. Using defined styles makes it possible to apply a color, fill pattern, and line style to an object with one click of the mouse button. And because the style and color palettes remain mapped to the objects in a drawing, you can edit a picture globally by redefining a style or a color.

If you are sending your illustrations to a Linotronic, you'll love FreeHand's control over output. The Colors command in the Preferences dialog box doesn't qualify as true calibration, but its adjustment options can help you to match your screen colors to printed output. FreeHand's use of PPD (PostScript printer description) files,

Adobe Illustrator

Are you creating illustrations, graphics, single-page designs or any other artwork using Windows™? Then you'll be glad to know there's a more precise, more productive and more powerful illustration program available. Adobe Illustrator™ 4.0 software for the Windows environment. The complete design tool for professionals.

"For professionals, Illustrator 4.0 for Windows is an exceptional do-it-all application..." InfoWorld, 1992

The program that provides precision control over all aspects of the creative process. You can draw smooth Bézier curves, lines and objects, then add text in ways never before possible with other programs. Adobe Illustrator 4.0 for Windows offers:

Publish ★★★★★

- ***Precision control***
- ***Unsurpassed text features***
- ***Professional color capabilities***
- ***Reliable, high quality output***
- ***High-speed performance***

FREE Demo Disk

Just call
1-800-833-6687
Dept. N, ext. 1447

The package includes Adobe Illustrator, Adobe Type Manager,™ Adobe™ TypeAlign™ and Adobe Separator™ software, plus 40 typefaces from the Adobe Type Library, a selection of predrawn artwork and a lot more. So call us at 1-800-833-6687, dept. N, ext. 1447. And get all the details on Adobe Illustrator 4.0 for Windows. Or simply ask for your nearest dealer. Then, take Adobe Illustrator on a test drive. And while you're at it, throw us a few curves. We can handle them better than anyone.

"[Adobe] Illustrator offers the functionality that a mature PC-based illustration market needs: precise drawing tools and bulletproof PostScript output." PC Magazine, 1992

ADOBE

Nothing handles the curves better than Adobe Illustrator 4.0 for Windows.

CIRCLE 368 ON READER SERVICE CARD

Adobe, the Adobe logo, Adobe Illustrator, Adobe Separator, Adobe Streamline, Adobe Type Manager, the Adobe Illustrator logo and TypeAlign are trademarks of Adobe Systems Incorporated which may be registered in certain jurisdictions. Windows is a trademark of Microsoft Corporation. All other brand or product names are trademarks or registered trademarks of their respective holders.
Copyright © 1992 Adobe Systems Incorporated. All rights reserved.

Let's Get Technical

Canvas for Windows and Designer offer precision drawing tools.

by James Karney

Two forthcoming products aimed at the technically inclined user offer clues about what the next generation of high-end graphics software will look like: Deneba's Canvas 3.0 for Windows and Micrografx's Designer, Version 4.0. Both bridge the worlds of illustration and CAD applications by providing the ability to create large-scale and very detailed drawings with very precise measurements and to manipulate objects as groups.

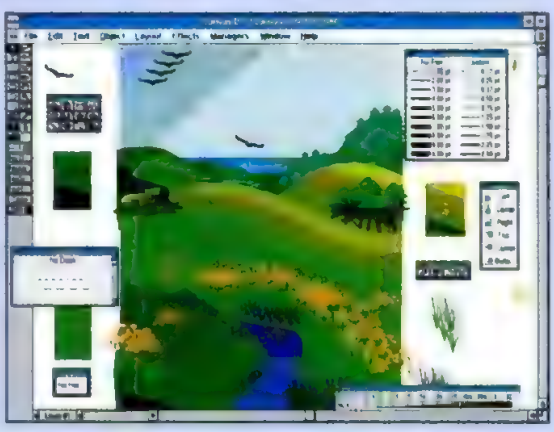
They also share a common software architecture; a core graphics engine that allows developers to add new features without reworking existing program code. Canvas has been using this approach on the Mac for some time and offers an application programming interface (API) toolkit so third parties can produce custom tools. For instance, both products offer specialized tools that draw concentric circles and outlines of company logos.

While neither product had reached beta testing at press time, we did see early versions; Canvas was in late alpha, and Designer was in early alpha. Here's a look at what's coming soon.

A FRESH CANVAS

Canvas 3.0 is a bit of a hybrid, providing high-end, technical-drawing tools coupled with built-in, true-color, bitmap-manipulation capabilities. In addition, you'll find everything you're used to finding in a professional drawing package plus tools for drawing parallel lines, user-definable compound objects, and hatch patterns; and programmable Smart Mouse functions, a collection of settings that constrain drawing or movement in relation to the page or other objects. You can also add bitmap frames in a drawing and then use standard paint-style editing tools such as pencils, spray cans, and a lasso. The same tools can be used to manipulate imported or scanned images.

Learning to use the program may be a bit daunting for the casual user: The program offers a lot of power, but the interface is a bit cumbersome and it takes a bit of practice and searching through the manual to identify the various components. It sports a host of more than 50 specialized tools, many of which can be accessed from on-screen tool palettes or from flyout menus. The program includes tools that draw cubes, arrows, and registration marks. Others produce tables, grids, and stars and draw lines at specific angles. On the plus side, the variety of tools simplifies drawing complex forms, and you can drop tools that you don't want from toolbars and menus or even create a custom desktop.



You can add bitmap frames in a Canvas drawing, then use paint-style editing tools such as pencils, spray cans, and a lasso.

Canvas' text handling rivals that of some low-end desktop publishing programs. You can flow text between frames, add it to and edit it directly on the page, use tabs, apply fractional leading, and kern pairs of letters. A spell-checker is also included. The positioning and dimensioning options exceed that of any PC-based drawing program, letting you, for example, automatically adjust an object to a rule or measure the diameter of several sections of a polygon at once.

The prerelease version we used did not have all the planned color features in place, but the final product is expected to support all the major color models, provide color separations with PostScript printers, and have the ability to trap using both chokes and spreads. Tools like these have wooed Mac users since 1987. Now, Canvas should find a home on a number of Windows machines in the near future.

A TOTALLY NEW DESIGN

With Version 4.0, Micrografx will be introducing a new interface for Designer that is patterned after the company's Windows Draw product; it will feature a button bar and menus that change options based on the current mode of operation. There will be only one selection tool, and you'll be able to cut and paste between several open drawings. Users who upgrade will discover the ability to undo actions limited only by memory and a file-management utility similar to CorelDRAW's Mosaic, which will include a filter for importing .CDR files.

But the changes are more than just skin deep. The level of precision and drawing-size range have been vastly improved: The smallest unit of measurement is now 0.5 microns (127,000 pixels per inch), and the largest available page size has been enlarged to 300 yards.

Handling objects in drawings will also be much easier. Watch for named styles for objects, multiple master pages, the ability to snap an element

to other objects, and better editing control with Bezier nodes. Sources at the company indicated that the new product will also offer some methods for creating 3-D objects.

Designer will no longer provide (or require) a special PostScript printer driver, and the program will act as both an Object Linking and Embedding (OLE) server and client. Color support is another area of improvement, with palettes for all the major models including CMYK, HSV, RGB, Pantone, Trumatch, and Focoltone. The basic package will allow manual black-component adjustment, while an add-on module will be available for advanced color separations, allowing under-color removal, trapping, dot gain, and ink adjustments.

The version we saw offers much better text handling than its predecessors, thanks to a type-manipulation engine licensed from a third party. Over 150 typefaces will be bundled with Version 4.0, along with Adobe Type Manager; the program will support both Adobe Type 1 and TrueType fonts. The final version is expected to allow text to flow from one frame to another and also to include kerning and tab controls, a spell-checker, and the ability to format any symbol as text or a line end. The new Designer is a worthy successor to a favorite with the more technically minded PC illustrators and should compete well with Canvas and Professional Draw.

The need to beat the competition to market with innovative features (or catch up fast) is more important than ever. Both these products will please sophisticated users with the skills and hardware to drive all the features offered, though newcomers should expect to spend some time learning the tools before they can take full advantage of them. We should also see many of the better ideas—the central core, an API, advanced color-separation support, and smart objects—incorporated into more programs. That means a new round of illustration software enhancements will be on the way. □

user-defined halftones, and a command that can split long paths at print time all work together to ensure quality output. These advanced controls were unable to prevent several printing problems we experienced with a 300-dpi color PostScript device, however; an imported TIFF file failed to print, and gradient fills exhibited noticeable banding.

Aldus FreeHand is not an all-in-one solution to your illustration needs, but it should appeal to the extremes of the illustration market. Professional artists seeking to round out their electronic toolbox will find FreeHand's masking and patterning functions worth the investment of a few hundred dollars. And business users will discover that the PageMaker-like palettes and a streamlined menu structure make FreeHand one of the easiest programs to learn and use.

Computer Support Corp.

Arts & Letters Graphics Editor

BY GAYLE C. EHRENMAN

If your drawing skills are weak, but you still want to turn out a professional-looking illustration, Arts & Letters Graphics Editor may be the package for you. This $695 program relies so heavily on clip art, you can create an entire illustration without drawing so much as a circle.

Arts & Letters takes a unique approach to illustration. Rather than offering a series of dedicated drawing tools for creating graphics primitives, such as squares and circles, it provides a library of clip-art symbols you can import and manipulate. There are a wealth of these symbols to choose from, in addition to over 8,000 high-quality clip-art images. In order to use one of these symbols, you must type its identification number in a dialog box. The program offers on-screen thumbnails for some of the most commonly used symbols, but for the most part, you must find what you're looking for in the *Clip-Art Handbook*. And while there is a symbol for virtually every shape, Arts & Letters has only two true drawing tools: a freehand curve tool and a line tool.

SUITABILITY TO TASK

Arts & Letters Graphics Editor

	POOR	FAIR	GOOD	EXCELLENT
Artistic illustration	●	●	○	○
Technical illustration	●	●	●	○
Color publishing	●	●	●	○

Once you've found the symbol you're looking for, Arts & Letters becomes easier to use. You can use the toolbox to add another symbol; to access the duplicate, skew, and rotate functions; to draw with one of the program's two drawing tools; or to change the line type and fill of your symbol. And, after you've converted your symbol to a free-form object, you can further customize it by either editing the nodes or by applying one of the transformation options accessible via the manipulation menu. Clipping, merging, and blending are some of the choices that are available here.

The clipping and merging options proved particularly useful in the creation of our Joe's Pizza test illustration. We positioned the inner portion of the window frame over the outer frame and cut a hole for it to fit into using the merge command. To create the frame around the illustration (and to clean up the rough edges of the underlying elements), we

FACT FILE

Arts & Letters Graphics Editor, Version 3.12

Computer Support Corp., 15926 Midway Rd., Dallas, TX 75244; 214-661-8960; fax, 214-661-5429

List price: $695

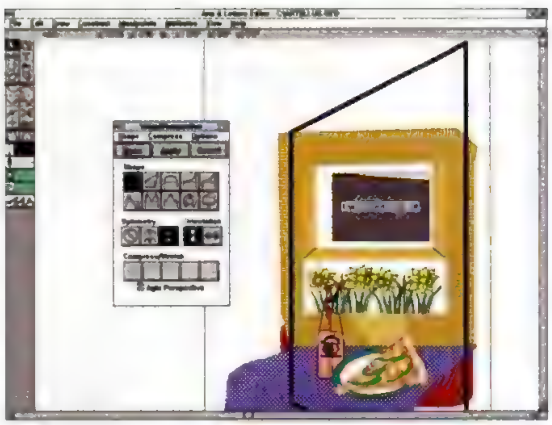
Requires: 286-based PC or better, 2MB RAM (4MB recommended), 27MB hard disk space, VGA display or better, DOS 3.0 or later, Microsoft Windows 3.x, mouse or other pointing device

In short: If your artistic vision is strong, but your drawing skills are weak, Arts & Letters Graphics Editor, Version 3.12, may be the package for you. There are few true drawing tools, which may frustrate professional illustrators, but business users will appreciate the vast selection of quality clip art. With a little patience, you can create attractive illustrations, but it is more of a struggle than it needs to be

489 ON READER SERVICE CARD

created a rectangle to use as a clipping path, or mask.

Arts & Letters is equally adept at creating complex gradient fills, such as the one we used for the wood-grain pattern in the window frame of the test illustration. It lets you specify the beginning and ending colors; the type and direction of the fill; the starting point and angle for the fill; and the number of times the fill should repeat. Once you've fine-tuned your gradient, you can name and save it as a pattern fill.



Arts & Letters' Warp/Perspective menu gives you control over the shape and symmetry of an effect and allows you to flip, mirror, stretch, and compress an object.

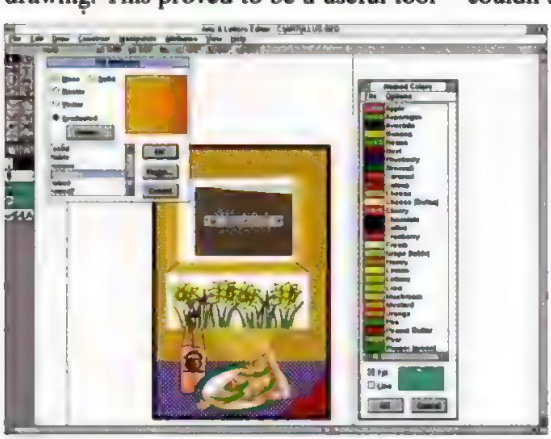
In addition to pattern fills, Arts & Letters allows you to name and save virtually any entity you create. You can create clip-art libraries and save images to them, save a group of text attributes or line attributes as a named style, or create named colors. Managing these named objects is easy, thanks to the newly added Clip Art Manager, which lists both the libraries and their contents. Also new is the Activity Manager, which makes it easier to find hard-to-access features such as the online tutorial and effects samples.

MIXED BAG

This package has much to offer in the way of tools for technical illustration. The most useful of these is the set-and-recall feature, accessible through the Construct menu. This option lets you specify exact angles and line lengths, save them, and apply them to other line segments in a drawing. This proved to be a useful tool for creating our very exacting gear drawing. Also useful is the program's ability to lock and hide objects, which almost makes up for its lack of layers.

When it comes to creative illustrations, Arts & Letters offers a mixed bag. The wide variety of symbols makes it easy to place something on the screen quickly. To create the pizza slice, we simply used a standard triangle symbol and clip-art peppers. Unfortunately, even the simple triangle shape had to be converted to free-form curves before it could be manipulated. The powerful perspective tools made it easy to "wrap" the label around the bottle, by simply picking from one of the preset patterns.

The autotracing and font handling, though, did not live up to these standards. Tracing the Joe's Pizza logo in our test proved to be a chore: Arts & Letters couldn't trace it at its original 300-dpi resolution. After sampling the logo down to a lesser resolution, the package managed to trace it, but only by treating each part of the logo as a separate object and tracing each separately.



You can name and save just about any attribute of an Arts & Letters object, including gradient fills, colors, and line styles, or save objects into the program's extensive symbol library.

The font handling is equally flawed. The package provides 90 proprietary typefaces and supports Type 1 fonts, but it lacks the margin controls and tabs necessary for working with blocks of text. It imported our block of text but could not strip out hard carriage returns. We had to rebreak lines manually to achieve shorter line lengths.

While Arts & Letters directly reads a variety of file formats, it comes bundled with Decipher, an adept file conversion utility that handles what the program doesn't directly support. It lets you convert .PCX, .GIF, and Targa files into TIFF format, which Arts & Letters imports directly. In addition, it can convert most flavors of PostScript to the package's native .GED format.

In addition to Decipher, the package includes a charting utility. While this module can be used to create a variety of chart types, including bar, area, line, and pie, it suffers from a limited data range (the maximum range is 5 columns by 12 rows) and limited formatting commands. You can, however, cut and paste data through the Windows Clipboard or import it in SYLK, .DIF, or text format.

Shortly after this story reaches print, Arts & Letters will be a greatly changed package. Version 4.0 (set to ship in April) should make the package easier to use; it adds flyout toolboxes, an attribute bar, and thumbnails and drag-and-drop operations under the Clip Art Manager. New features include real drawing tools, object extrusion, global color correction, and the ability to work directly with a broader selection of file formats.

Novice illustrators will appreciate the freedom and power Arts & Letters gives them. But its reliance on clip art and limited number of dedicated drawing tools are liable to frustrate professional artists. You can turn out impressive-looking illustrations with this package, but its unintuitive mode of operation makes it tougher than it needs to be. Wait for the next version, which should remove many of these obstacles.

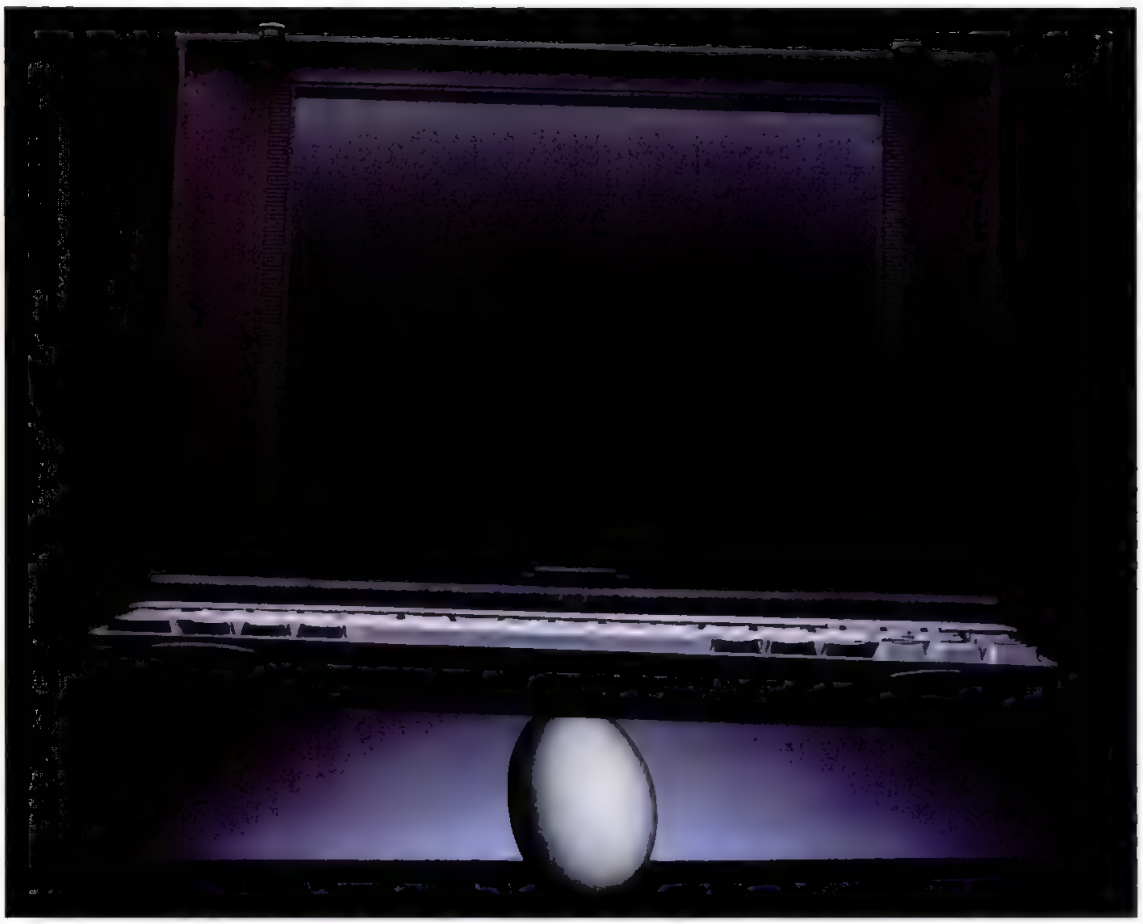
Corel Systems Corp.

CorelDRAW

BY DANIEL WILL-HARRIS

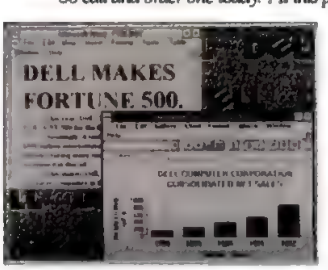
CorelDRAW 3.0 remains a top seller for good reason: It combines power, ease of use, and value. The simple toolbox and roll-up menus create a convenient environment for design, while the easy text handling and wealth of fonts make it an alternative to DTP programs for short documents. By the time you throw in the

THERE'S NOTHING LIGHTWEIGHT ABOUT THIS 3½ POUND NOTEBOOK.



At just over 3.5 lbs, the Dell® 320SLi offers features and functions usually reserved for systems twice its weight. So call and order one today. At this price, it shouldn't be a heavy decision.

You're not the only one working late. Dell's toll-free support lines are now open 6AM to midnight every day. There's also nationwide on-site service and a 24-hour TechFax™ line.△

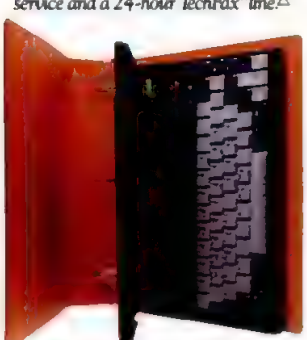


Comes with everything you need to run even the most hardcore software: MS-DOS® 5.0, Microsoft® Windows™ 3.1, Lotus® Organizer and a keyboard mouse.

intel inside

That's not all you'll find in here. There's room for a modem, coprocessor, 120 MB hard drive and up to 10 MB of RAM.

Your hands don't get smaller just because your computer does. So Dell gave the 320SLi a full 85-key keyboard, including special screen navigation keys in the familiar inverted-T layout.



We call it a notebook, but it's actually smaller. Just 7¾" x 11" and only 1¼" thick. So you might actually be able to fit some briefs in your briefcase. Maybe even a sandwich or two.

$1,699

LEASE ◇ : $63/MONTH

This small number gets you all these big numbers: 20 MHz i386™ SL processor, 2 MB of RAM, 60 MB hard drive, VGA Reflective (9.5", 640 x 480) LCD, external 3.5" floppy drive and up to 4 hours of work from the NiMH battery.

DELL

800-348-8348

WHEN CALLING, PLEASE REFERENCE **#11BDL**

HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN

IN CANADA, CALL 800 668-3021. IN MEXICO CITY, 228-7811.

△Service provided by Basic Tech Service Corporation. On-site service may not be available in certain remote locations. ◇Leasing arranged by Leasing Group, Inc. i386 is a trademark and the Intel Inside logo is a registered trademark of Intel Corporation. MS-DOS and Microsoft are registered trademarks and Windows is a trademark of Microsoft Corporation. Lotus is a registered trademark of Lotus Development Corp. FORTUNE 500 is a registered trademark of The Time Inc. Magazine Company. Dell disclaims proprietary interest in the marks and names of others. ©1993 Dell Computer Corporation. All rights reserved.

Two New Faces for OS/2

by James Karney

There is good news for OS/2 users. After a long lull in graphics application development for that operating system, things are starting to pick up; Corel Systems Corp. and Micrografx have finally issued the long-awaited updates to the OS/2 versions of their illustration packages.

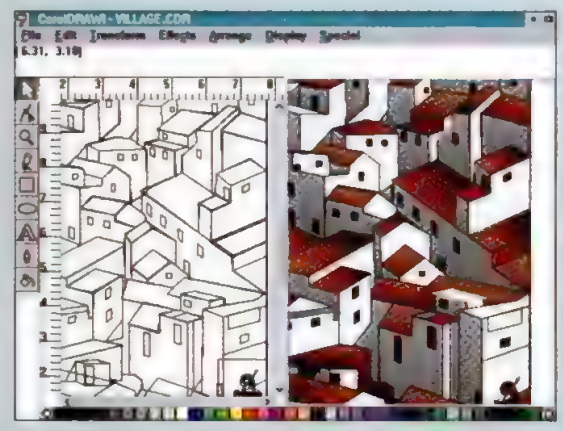
CorelDRAW 2.5 for OS/2 is really a full 32-bit version of CorelDRAW 2.0 with some friends. The popular program's interface is virtually unchanged from the last release, but now the program ships bundled with two Microsoft Windows applications—CorelChart and CorelPhotoPaint. The box also contains OS/2 versions of CorelTrace, Mosaic, and WFNBoss, which allows users to convert fonts to and from CorelDRAW 2.*x*'s proprietary format (Version 2.5 still uses the older .WFN fonts).

You'll find the font converter comes in handy, since the OS/2 product ships with the same 200-plus PostScript Type 1 fonts that come with the Windows version. Corel has also included all the updated import and export filters designed for the 3.0 release, as well as support for the new CorelDRAW .CDR metafile; thus you can open any file created with the latest Windows version in the OS/2 product, an essential measure for cross-environment compatibility.

While those who use OS/2 will have to put up with a wireframe work area and a separate preview window, Corel Systems has removed the 1,643-object maximum that existed under Version 2.01; now it is only limited by memory. If you are already used to CorelDRAW, Version 3.0, under Windows, it will probably be hard for you to move back to the old interface and reduced feature set. If all that you know and use is OS/2, however, you will find that CorelDRAW is an extremely powerful performer.

THE SAME DESIGN

Micrografx's Designer is a full implementation of Version 3.0 of the Windows product (Version 3.1 includes OLE and TrueType support, neither of which are supported by OS/2). Like CorelDRAW's Mosaic utility, Designer was ported using Mirrors, Micrografx's toolkit for converting Windows system calls to their OS/2 equivalents. Otherwise, all of the illustration tools and program features work the same in the OS/2 product as in the Windows product.



CorelDRAW 2.5 for OS/2 is based around the CorelDRAW 2.0 drawing engine, combined with the modules of the latest Windows version. (The image used here is by Norbert Chausses.)

If you have installed IBM Corp.'s service pack (basically a minor upgrade), you may encounter some bugs with Designer, according to one source at Micrografx. We ran the program with and without the service pack with no problems, however.

The major benefit of illustrating under OS/2 is the 32-bit graphics engine, which seems to improve screen operation. We found that on a 486/33 with 8MB of RAM, file opening and screen redraws for both packages were faster than the same operations performed under Windows on the same machine, thanks to OS/2's ability to optimize throughput for CPU and I/O operations. We were not using HPFS (High Performance File System), which theoretically could increase speed even more.

Another bonus is OS/2's true background printing, which lets you send a job to the printer and immediately work with another application, without the performance degradation you frequently experience under Windows. As a result, working with large files or complicated images can go much more smoothly than it tends to go under Windows.

The minuses stem from OS/2's smaller user base. It has found a home in many corporations as a LAN server, but most servers aren't used for graphics applications. At the time of this writing, there were few or no 24-bit display drivers for OS/2. S3 is working on one, but it was not yet in beta testing as of this writing. The same holds true for fancy graphics tablets, full-page monitors, and other hardware requiring special drivers. While most PC graphics applications run under Windows, running a program in a Windows box under OS/2 defeats most of the purpose of using the the more powerful operating system.

Finally, many illustrations are created for use in other applications, most notably desktop publishing. But your only choice for off-the-shelf, OS/2-based DTP software is the outdated Ventura Publisher for OS/2.

Dyed-in-the-wool Windows users and buyers for whom the operating environment is of secondary concern will not be wooed away by the OS/2 version of CorelDRAW or Designer. But for OS/2 users, the upgrading of these products is certainly a welcome event; they have got two fine products from which to choose. □

SPLIT DECISION

THE CASE FOR THE ULTIMATE IN TECHNOLOGY:
M X 1 5 F

- 15-inch Microprocessor-based Color Monitor.
- Flat Square Technology Picture Tube with Invar Shadow Mask.
- 0.28mm Dot Pitch.
- 1280 x 1024 Non-interlaced Resolution.
- Intelligent Mode Switching.
- Digital Controls.
- LED Indicators for Mode and Status Information.
- Vertical Refresh Rate up to 76 Hz at 1024 x 768.

THE CASE FOR THE ULTIMATE IN VALUE:
L X 1 5 6 4

- 15-inch Flat Square Technology Color Picture Tube with Invar Shadow Mask.
- 1280 x 1024 Resolution.
- Ergonomic Analog Controls.
- Automatic Synchronization and Sizing.
- Vertical Refresh Rate up to 76 Hz at 1024 x 768.

When it comes to advanced technology there's no debate. The MX15F has it all. From its super-sharp image to an on-board processor, ultrahigh resolution, optimal synchronization and sizing, LED status read outs and more...much more.

Ideally suited for high-level engineering, scientific, graphic and business applications, the MX15F is the computer monitor of choice for serious power users.

It's no wonder the MX15F has won so many awards. These include *PC Magazine* Editors' Choice-1991 and *PC World's* Best Buy in both 1991 and 1992.

Clearly, this is the monitor for those who refuse to compromise. It delivers the very highest performance, quality and technology.

1991 1991 1992

MAG Innovision, Inc.
4392 Corporate Center Drive
Los Alamitos, CA 90720
714/827-3998 FAX: 714/827-5522

For high performance at an affordable, competitive price, the new LX1564 is the popular choice.

Using the advanced 15-inch flat square picture tube in combination with an economical design, it offers a true melding of high-performance and economy.

And, with features like edge-to-edge overscan and 80 MHz video bandwidth, the LX1564 compares well against competitor's higher priced models.

THE CHOICE IS YOURS

Two great monitors. Two sets of features. Designed to fit the way you work. Designed to fit your budget. The choice is yours – Ultimate Technology or Ultimate Value.

Can't decide? Give us a call at 1-800-827-3998, extension 1303. We'll be glad to help.

MAG INNOVISION

CIRCLE 067 ON READER SERVICE CARD

included assortment of additional programs for charting, painting, and organizing images, CorelDRAW emerges as an all-around graphic powerhouse for both business and professional users.

CorelDRAW is known for its clean, deceptively simple interface. It has only a few tools, but they're quite flexible. For example, you can use Node Edit to edit Bezier curves, kern text, change letter and line spacing, change corner radii, or slice circles into arcs or pies. In addition to these multipurpose tools, the latest version of the program adds a useful new interface feature: the roll-up menu—a floating dialog box that can be placed anywhere on-screen. The roll-ups, combined with CorelDRAW's streamlined toolbox, mean that you do not have to search through a large number of tools to get the job done.

CorelDRAW now also has the ability to edit in preview mode, so you can work on full-color images instead of wireframes. This means that you will spend less time flipping between modes and have more screen with which to work.

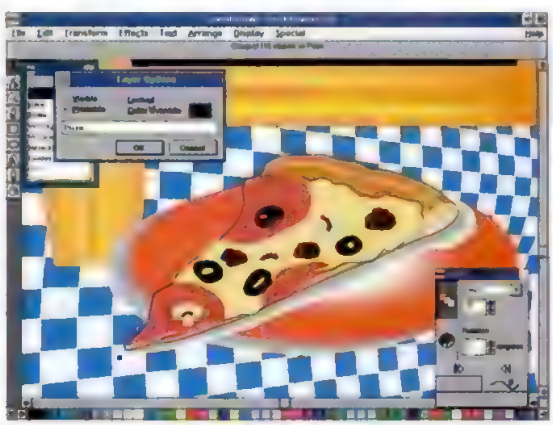
One area where CorelDRAW excels is text handling. The program supports both TrueType and Type 1 equally (as well as Corel's older .WFN format). The text dialog provides on-screen previews of what text will look like set in a specific typeface. This is a unique and helpful feature, because even professionals can be aided by not having to guess how a particular word will look. Each text block can be up to 8K long, and each character in the block can be individually manipulated for font, size, color, or even angle. CorelDRAW gives the user the tools necessary to set unjustified type correctly, and it includes hyphenation, a spell-checker, and a thesaurus.

SUITABILITY TO TASK

CorelDRAW

	POOR	FAIR	GOOD	EXCELLENT
Artistic illustration	●	●	●	●
Technical illustration	●	●	○	○
Color publishing	●	●	●	○

For creating, editing, and organizing complex illustrations, CorelDRAW's layer implementation is hard to beat. You can lock objects on a layer and control how they are viewed and printed. This helps speed work, since you can hide complex parts of images or display them only as wireframes. To change the order of layers, you drag them within their roll-up menu. The only thing missing is a single dialog box where you can control the attributes of all layers at once.



CorelDRAW's layer feature speeds working on complex graphics by allowing you to view certain layers in wireframe, so the illustration takes less time to redraw.

COMING TO YOU LIVE

CorelDRAW is known for its special effects, and in 3.0, these effects are "live": When you change an object, the effects are updated automatically. This is especially useful for operations such as fitting text to a path, because when you change the text attributes, the text is automatically reset to the path. The text-to-path roll-up gives you many different ways to set the text on the path, and it allows you to place text on the other side of the path. You can set text placement either numerically through the roll-up or interactively; for example, you can select the text using the node-edit tool and drag it around the path interactively, making exact placement easier. Other effects include blending and extruding (complete with a light source to create realistic shadows); a change made to one of the control objects automatically updates the blends or extrusions. Envelopes for warping and adding perspective remain a CorelDRAW staple.

CorelDRAW is unique among the products reviewed here in that it includes several other powerful applications in the package: CorelPhotoPaint, a full-featured 24-bit color image-editing program (ZSoft Corp.'s PhotoFinish 1.0); CorelTrace, a standalone autotracing utility; CorelMosaic, an image-organization program that displays and prints thumbnails of CorelDRAW and bitmap files and allows the user to enter and search for keywords; CorelSHOW, a limited OLE-based presentation program; and CorelChart, a charting program. Finally, the package includes a CD-ROM containing all the programs, as well as 12,000 pieces of excellent professional-quality clip art, 100 additional fonts, all 250 fonts in Type 1 format, and templates and animations for CorelSHOW.

SMOOTH OPERATOR

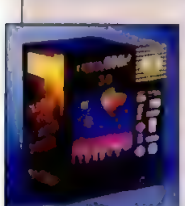
Overall, CorelDRAW is a smooth, professional-caliber tool. Its import and export capabilities are excellent: It successfully imports an array of different file types, and it can correctly export even calligraphic lines. It automatically breaks long paths into smaller pieces upon export, and the PSComplexityThreshold setting in its .INI file helps you avoid

PC EDITORS' CHOICE

FACT FILE

CorelDRAW, Version 3.0

Corel Systems Corp., 1600 Carling Ave., Ottawa, Ontario K1Z 8R7, Canada; 800-836-3729, 613-728-8200; fax, 613-762-9176



List price: CD-ROM, $549; with floppy disks, $595. Upgrade, $149; competitive upgrade, $199.

Requires: 286-based PC or better, 4MB RAM (8MB recommended), 4.5MB hard disk space (20MB for full installation), VGA display or better, Microsoft Windows 3.*x* (3.1 recommended), mouse.

In short: It's hard to beat CorelDRAW's combination of power and value. Professional users might long for the color support and better long-text handling found in other illustration programs, but they also may end up coming back to CorelDRAW's comfortable and efficient interface. Business users may find that CorelDRAW is the only graphics package they need.

478 ON READER SERVICE CARD

THE MOST POWERFUL UPGRADE EVER FOR HARVARD GRAPHICS.

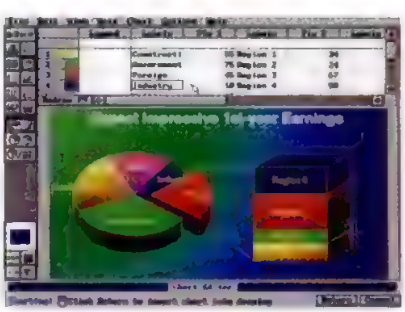
ANNOUNCING WORDPERFECT® PRESENTATIONS.

An easier, faster way to create world-class presentations is here. And the big news is it isn't from Harvard.

It's new WordPerfect® Presentations. Available now for DOS and very soon for Windows.

Under the bold headline "Harvard Beware," *PC World* (9/92) says our DOS version is "as much like Windows as DOS gets. Even industry leader Harvard Graphics for DOS doesn't look as graphical or as slick." *PC Computing* (12/92) raves that Presentations "outdoes most Windows programs not only in the usefulness and breadth of its features, but also in its graphical interface."

Our graphical interface brings Windows-like ease to DOS. And since our Windows version is almost identical, there's no learning curve if you move up.



Unlike other programs, you don't have to navigate back and forth between the data input screen and your chart. With the Split Screen Editor, changing the data on top instantly changes the chart below.

Incidentally, both our Windows and DOS versions work almost exactly alike. Making it painless to move over. And to make it even easier, a free Windows license is included with your DOS purchase.

WORDPERFECT IS A REGISTERED TRADEMARK OF WORDPERFECT CORPORATION WITHIN THE UNITED STATES AND OTHER COUNTRIES. ALL OTHER BRAND AND PRODUCT NAMES ARE TRADEMARKS OF THEIR RESPECTIVE COMPANIES. ©WORDPERFECT CORPORATION 1993

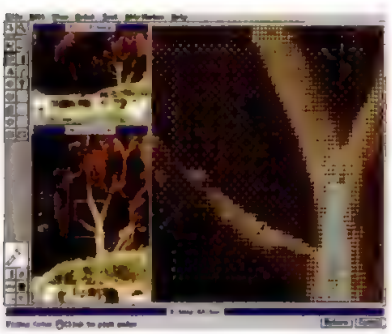
With a single point and click, the Button Bar™ lets you do things that take multiple keystrokes in Harvard. And you can even customize the Button Bar with powerful editing tools.

Why We Sound So Much Better Than Harvard.

We offer sound and music capabilities you won't find in any other presentation software. Including support for 20 popular sound cards and a library of more than a hundred MIDI music files.

Can We Paint You A Picture?

Harvard and Freelance can't. WordPerfect Presentations is the only presentation program for DOS that includes paint tools. And the only one that gives you the ability to convert bit-map images into the vector format. So you can quickly edit lines and curves. Over 1,000 clip art images are included, each of which can be customized using Presentations' sophisticated editing tools.



No other DOS – or Windows – presentation software includes paint tools. Create your own color scanned images – or edit scanned images with ease.

Create Slide Shows Automatically.

With our Outliner, you don't have to be creative to create a slide show. Just type in your information – or import an outline from WordPerfect – and it puts your text in order onto slides. And there are many more exclusive features. So many, that we've decided to give you 90 days to try them all out risk-free. Owners of Harvard, Freelance and other competitive products also qualify for a special $129 trade-up price.

The unique Slide Sorter puts all your slides on screen and lets you rearrange them with a click and a drag. And with the Slide Editor, you can zoom in close and make changes on any slide.

Plus everybody is entitled to WordPerfect's legendary toll-free support.

Take A Free Test-Drive.

To try WordPerfect Presentations before you buy, just call (800) 526-5043 for a free working copy. Or call for our quick and simple Demo Disk instead. Do it now. And see why the most powerful upgrade ever to Harvard or any graphics package could only come from WordPerfect.

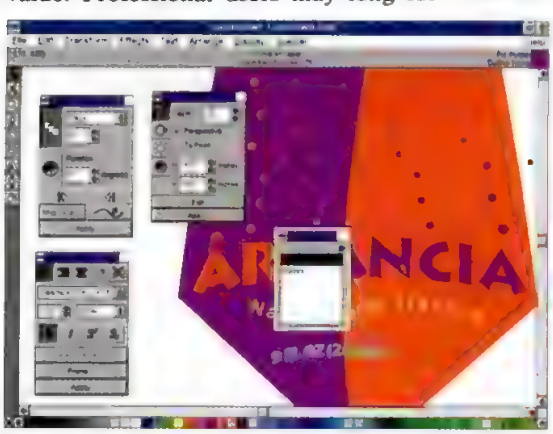
WordPerfect®

overloading PostScript devices. In addition, you can use OLE to paste a graphic into another program, then edit it later by double-clicking on it.

Still, despite its professional status, CorelDRAW lacks some features that have become standard among illustration programs. Most of these have to do with the program's ability to create full-page layouts. For example, CorelDRAW documents can only be one page long, making multipage projects difficult. CorelDRAW's otherwise excellent text handling is limited by an inability to flow text from one text block to another, flow text around other objects, or place text inside irregularly shaped objects.

In addition, the program lacks any kind of color calibration and the ability to store commonly used styles and settings. Even without these features, however, CorelDRAW is still a capable product that can handle text-heavy layouts on its own.

In the past, CorelDRAW has been updated every 12 months, so a new version should be forthcoming around mid-1993. This new version should contain the missing features mentioned here. Even with these omissions, it's hard to beat CorelDRAW's combination of power and value. Professional users may long for color calibration and better long-text handling found in other illustration programs, but they also may end up coming back to CorelDRAW's comfortable and efficient interface. And business users may find that CorelDRAW is the only graphics package they need.



CorelDRAW's unique roll-up menus give you instant access to layer, fill, pen-style, text, blend, text-to-path, and extrude functions.

Micrografx Inc.

Designer

BY PAUL MURPHY

The roots of Micrografx's Designer ($695) run deep in the world of Microsoft Windows–based illustration software. It was one of the first programs to transform Windows from nifty to truly useful. Although it wasn't until Windows 3.0 appeared on the scene that most design departments started to take Windows seriously as a platform, Designer had already taken hold in many (including *PC Magazine*'s). Its sterling reputation as an illustration tool with the soul of a CAD program for designers who require precision controls has made its reputation and remains its hallmark.

SUITABILITY TO TASK

Designer

	POOR	FAIR	GOOD	EXCELLENT
Artistic illustration	●	●	●	○
Technical illustration	●	●	●	●
Color publishing	●	●	●	○

Complex drawings such as those created in our test suite can have many overlapping objects; it's easy to manage these drawings and objects, though, thanks to the program's support for layering. This, however, is not where Designer's similarity to CAD programs ends. You can name objects or groups of objects and recall them for later use within a drawing or save them as clip-art symbols.

Lists of named parts or symbols can also be exported for inclusion in spreadsheet or word processing documents—a great help for simple facilities management or parts lists.

Additionally, Designer can perform simple associative dimensioning, though not nearly as fully as most CAD programs can, and has a broad set of snap options available (though curiously, not snap to grid as one might expect).

Designer's array tool is every bit as powerful as that found in most CAD packages—in some ways more so, since it allows you to apply controls to color blends as well as size and position. As with CAD programs, Designer allows objects to be drawn to scale using a wide variety of measurement systems, and it actually has a wider range of object tools than even many high-end CAD products. The implementation of these measurement tools, as well as the position controls, is excellent.

LACKS BREADTH

Despite its CAD-like demeanor, however, Designer is not CAD software. Its color and text handling belie the fact that Designer is fundamentally a tool for graphic designers who can benefit from its precision and features.

It is in its role as a graphics design tool where it begins to fall a bit short, however. The program lacks special-effects tools for object and text manipulation. While Designer has a simple blend tool, it isn't nearly as powerful as the program's array command, which can be used to do the same thing. The only object effect available here is slanting.

Text can be bound to a curve in Designer or exported for manipulation to

FACT FILE

Designer 3.1 plus OLE

Micrografx Inc., 1303 Arapaho, Richardson, TX 75081; 800-733-3729, 214-234-1769; fax, 214-994-6475

List price: $695.

Requires: 286-based PC or better, 2MB RAM, 4.5MB hard disk space (12MB to 20MB recommended), DOS 3.0 or later, Microsoft Windows 3.0 with Adobe Type Manager or Windows 3.1, mouse or tablet.

In short: This longtime favorite is starting to show its age. Though its interface can be a bear, Designer is still a powerful illustration program with a variety of CAD-like tools, including a powerful array command, that make creating precision drawings a breeze. Look for the next version to offer an improved interface and more sophisticated type handling, which should make this old standby a tough competitor again.

471 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES CONTINUES

Professional Illustration Software

Products listed in alphabetical order

■ = YES □ = NO

	Adobe Illustrator (PC Editors' Choice)	Aldus FreeHand	Arts & Letters Graphics Editor	CorelDRAW (PC Editors' Choice)	Designer	Professional Draw
List price	$695	$595	$695	$595	$695	$595
General Features						
On-line tutorial/Paper tutorial	□■	■□	■□	■□	■■	□■
Toll-free technical support number	□	□	□	□	□	□
Technical support hours (eastern time)	9:00–8:00 M–F	10:00–8:00 M–F	9:30–7:30 M–F	4:00 A.M.–8:00 P.M. M–F	24 hours M–F, 9:00–6:00 Sat. and Sun.	9:00–8:00 M–F
Company-run BBS/CompuServe support	□■	□■	□□	■■	■■	■■
Workspace:						
Multiple open windows	■	■	□	□	□	□
Lock and hide objects/layers	■□	■□	■■	□■	■■	■■*
Maximum number of layers	1	Unlimited	1	Unlimited	64	Unlimited
Illustration Tools						
Drawing primitives:						
Arcs	□	□	□	□	■	■
Circles	■	■	□	■	■	■
Center and diameter	■	■	N/A	■	□	■
Concentric/3-point	□□	□□	N/A	□□	■□	□■
Ellipses	■	■	□	■	■	■
Axis and eccentricity	■	■	N/A	■	□	■
Center and two axes	■	□	N/A	■	□	■
Polylines/Polygons	■□	■□	■□	■□	■□	■■
Close curved paths automatically	■	■	■	□	■	■
Chamfers and fillets	□	□	□	□	■	■
Gradient fills	□	■	■	■	■	■
Intelligent connecting lines	□	□	□	□	□	■
Measurement systems:						
Inches/Feet and inches	■□	■□	■□	□□	■■	■□
Metric system	■	■	■	□	■	■
Points/Picas	■■	■■	□■	■■	■■	■■
Alignment Tools						
Align to baseline/to page	■□	□■	■■	□■	■■	■■
Object snaps:						
Baseline/Center	■■	□■	□□	□■	□■	■■
Grid/Ruler	■□	■□	■■	■■	□■	■■
Intersection/Perpendicular	□□	□□	□□	□□	■□	■■
Midpoint/Endpoint	□■	□■	□■	□■	■■	■■
Nearest point	■	■	■	■	■	■
Quadrant/Tangent	□□	□□	□□	□□	□□	■■
Object Manipulation Tools						
Break and combine objects	■	■	■	■	■	■
Clip bitmap to object	■	■	□	■	■	■
Copy or reuse object attributes	□	■	■	■	□	■
Special effects:						
Blend/Extrude	■□	■□	■□	■■	■□	■■
Perspective/Warp	□■	□□	■■	■■	□□	■■
Text Handling						
Font formats supported:						
Adobe Type 1	ATM required	ATM recommended	Native support	ATM required	ATM required	Native support
Bitstream Speedo	Unsupported	Unsupported	Unsupported	FaceLift required	Native support	Unsupported
TrueType	□	■	■	■	■	■

N/A—Not applicable The product does not have this feature *Hides layers but does not lock them

ViewSonic
ViewSonic 17

The New Generation 17" Monitor

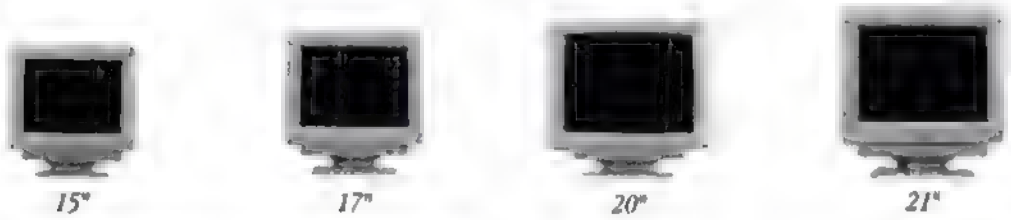
Advancing into the future is the powerful, new generation ViewSonic 17... with crispness and clarity unheard of before now. So, if a high-contrast, extremely bright, sharply focused screen is important to you, this is the answer! Plus, this remarkable monitor runs at 76Hz refresh at an astonishingly high 1,280 x 1,024 and beyond, which will give you a flicker-free image.

Our unique ViewMatch™ color control is an easy-to-use system that takes the guess work out of printing by adjusting colors to closely match printer output. Brighten the red. Lighten the blue. No problem; it works. And the ViewSonic 17 even has an ergonomically designed drop-down control panel that's as simple to use as a typewriter. More great features include digital controls and advanced anti-reflection coating ...all adding up to make this everything a 17" monitor should be. With its big screen display and edge-to-edge image, this is the monitor of choice for Windows, desktop publishing and CAD/CAM applications.

For safety and vision protection, the monitor meets strict MPR-II and ISO 9241-3 standards.

Call **800-888-8583** for more information on our products, including our new line of 15" through 21" monitors.

Welcome to the New Generation.



15" 17" 20" 21"

All products and brand names are registered trademarks of their registered companies

ViewSonic®

20480 Business Pkwy Walnut, CA 91789
Tel. (909) 869-7976 Fax (909) 869-7958

CIRCLE 118 ON READER SERVICE CARD

Illustration Software

SUMMARY OF FEATURES

ENDS

Products listed in alphabetical order

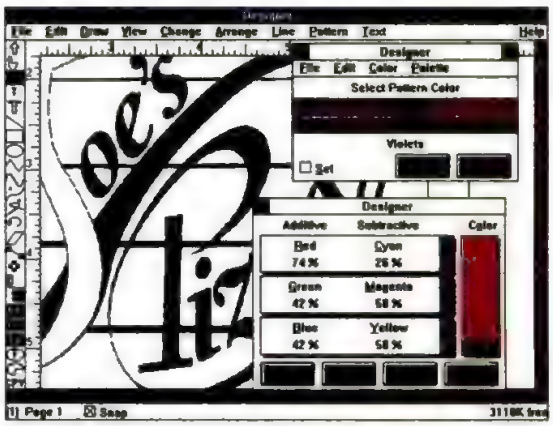
■ = YES □ = NO

	Adobe Illustrator	Aldus FreeHand	Arts & Letters Graphics Editor	CorelDRAW	Designer	Professional Draw
Text Handling (continued)						
Point sizes supported	0.1–1,296	0.1–3,000	8–3,200	0.7–2,160	2–unlimited	4–1,024
Align text on baseline	■	□	■	■	■	■
Kerning and leading/Tracking	■■	■□	■■	■■	■■	■■
Graphic Handling						
Imports/Exports:						
.BMP	■■	■□	■■	■■	□□	■■
.CDR (CorelDRAW)	□□	□□	□□	■■	□□	■□
CGM	■■	■□	□■	■■	■■	■■
.DRW (Designer)	■■	■□	□□	□□	■■	■□
.DXF	■■	□□	□□	■■	■■	■■
Encapsulated PostScript:						
.AI format	■■	■■	■■	■■	■■	■■
With TIFF header	■■	■■	■■	■■	■■	■■
With .WMF header	□□	■□	■■	□□	■□	□□
.GED (Arts & Letters)	□□	□□	■■	□□	□□	□□
.GEM (GEM vector)	□□	□□	□□	■■	■■	□□
HPGL	□□	■□	□□	■■	□■	□■
.PCX	■■	■□	■■	■■	■■	■■
PhotoCD (import only)	□	□	□	■	□	□
Pict (Macintosh)	■■	□□	□□	■■	■■	□□
.TGA	□□	□□	■■	■■	□□	□□
TIFF	■■	■■	■■	■■	■■	■■
.WMF (Windows Metafile)	■■	■■	■■	■■	■■	■■
.WPG (WordPerfect Graphics)	■■	□□	□■	□■	■■	□□
Export selected objects	□	■	■	■	■	■
Selectable export size/resolution	■■	■■	□■	■■	■■	□□
Trace color bitmaps	■	■	□	■	■	■
Output						
Screen shows	□	□	■	■	■	□
Print options:						
Break complex curves	■	■	□	■	■	□
Center on page/Fit to page	□□	□■	□□	■■	□□	□■
Header and footer/Margins	□□	■□	□■	□□	□■	□■
Multiple images per page	□	□	■	□	■	□
Selected objects	□	□	■	■	□	■
Specify number of bands in gradient	N/A	□	□	■	□	■
Specify curve flatness	■	■	□	■	□	■
Globally/For objects	□■	■■	N/A	■■	N/A	■□
Trim marks/Registration marks	■■	■■	■■	■■ (PostScript only)	■■	■■
Color-matching models supported:						
Pantone Matching System	■	■	□	■	□	■
Trumatch/Focoltone	■■	□□	□□	■□	□□	□□
Color Separation Options						
GCR/UCR	□■	□□	■■	□□	□■	■■
Black generation	□	□	■	□	■	■
Dot-gain compensation	□	□	□	□	□	□
Ink correction	□	□	□	□	□	■
Specify C,M,Y,K frequencies/angles	■■	□■	■■	■■	■■	■■
Print individual plate	■	■	■	■	■	■
Print separation labels/step scale	■■	■■	■□	■□	■□	■□

N/A—Not applicable: The product does not have this feature

the OEM version of Adobe Type Align that Micrografx supplies. Designer ships with 180 Adobe Type 1, Bitstream, and TrueType fonts, as well as Adobe Type Manager.

There is no provision for interactive kerning or spacing, but all control dialogs are easy to use. You can easily import text either directly or via the Windows Clipboard and then edit it on the page or use the text editor. Text can be easily converted to curves and then filled with gradients and patterns.



Colors are contained in supplied palettes, but Designer allows you to edit them or create new palettes using CMYK, RGB, and HLS color models.

Much greater control over text is available in TypeAlign, which can be started from a menu item. There, text can be placed along curves, skewed and warped interactively, and then imported into Designer via the Windows Clipboard.

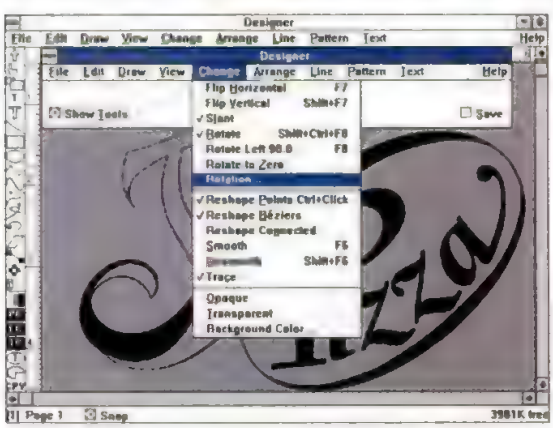
Objects and text from Designer cannot be imported through TypeAlign's proprietary clipboard, however, so it can sometimes be tricky to get curved or skewed text created in TypeAlign to match objects in your Designer drawing properly. Overall, we found this combination to be significantly inferior to CorelDRAW's enveloping, perspective, and text-manipulating abilities.

Designer's color-handling capabilities are adequate. The program ships with an assortment of named color groups; you can add additional colors to a group using RGB, CMYK, or HLS color models. You can also create new palette groups to hold your custom colors. But while other illustration programs allow you to mix and apply color directly from the color models, Designer requires that colors be added to palette groups first, a rather inconvenient method. Pantone color matching, while supported, requires that you purchase a separate color palette from Micrografx.

Designer's gradient tool allows you to fill objects with linear, radial, and rectangular gradients, but it does not provide very flexible color control. Gradients always fill from the current background color to the current fill color; to change either of these, you must use the color selection dialogs.

CUSTOMIZABLE TOOLBOX

Designer's toolbox is rather two-dimensional for the Windows 3.1 era. Tools are not layered as in other drawing programs; thus the toolbox is limited in its effectiveness. You can, however, add any menu item to the toolbox, provided there is an open, visible slot. The higher the screen resolution, the more tool slots are available. In addition, you can define the second mouse button to perform any menu command with a single click. This can come in handy for quickly opening dialog boxes, such as color and fill.



Micrografx's Designer allows you to add any menu item to the toolbox, although screen resolution limits the number of tools that can fit.

In addition to some of the changes already mentioned, Designer can now act as an OLE (Object Linking and Embedding) client, allowing you to embed drawings in other OLE-supporting applications. The OLE facility worked properly and seamlessly in casual testing with Microsoft Word.

Despite these few changes, serious competitors have emerged in the past two years, and Micrografx has begun to play follower in both breadth of tools and interface design. While Version 4.0 is expected to include a complete overhaul of its working interface (see the sidebar "Let's Get Technical"), the present Version 3.1 has a rather mundane toolbox and resorts to extraneous programs to perform meager special-effects functions that other illustration packages perform in-house.

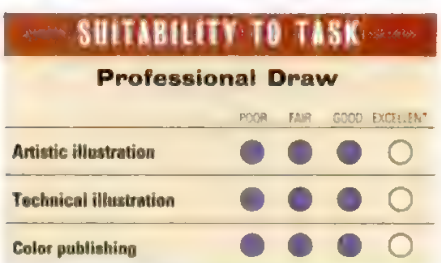
With a new interface and some of the features that are currently being performed by external programs incorporated into the core program, Designer will be as fresh and robust in its next release as any of its competitors. Meanwhile, its technical drawing capabilities are as powerful as ever.

Gold Disk Inc.

Professional Draw

BY DANIEL WILL-HARRIS

Gold Disk's Professional Draw offers a wealth of innovation: Everywhere you look, there are features you've never seen in another program. These include tool modifiers that help when creating complex illustrations, exceptional color handling and text handling, an extrude that produces smooth 3-D results, and support for multiple pages. Yet despite (or perhaps because of) the program's exceptional differences, users more familiar with standard illustration programs may find the interface awkward.

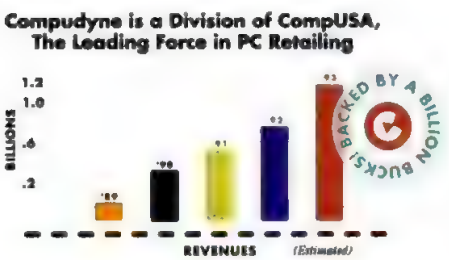


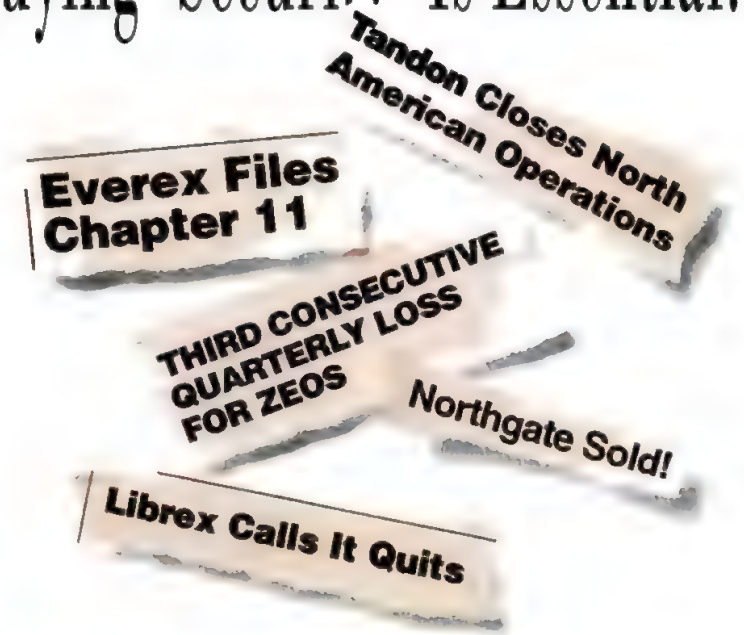
Performing basic tasks is very easy—easier in fact than in other illustration programs. For example, the Scissors tool

These Days Buying 'Security' Is Essential.

Only Compudyne gives 'big brand' security, the lowest prices and the latest technology!

We're the PC manufacturing and direct marketing arm of CompUSA,™ The Computer





Based on stories published within 3 months prior to going to press.

SuperStore, that revolutionized computer retailing with the deepest discounts, widest selection and best service. Today CompUSA (NYSE symbol: CPU) is the dominant force in computer retailing.

Guaranteed Lowest Prices.

At Compudyne we guarantee that if you can find a PC that meets or exceeds our equivalent specifications, but is shipping at a lower advertised price, we'll beat that price.

Unbeatable Technology.

Our massive buying power not only lets us offer the absolute lowest prices, but lets us deliver cutting-edge technology in every one of our systems. For example...

ALL SYSTEMS COME WITH MONITORS!

State Of The Art Upgradeable VESA Local Bus Board!

- Runs any Intel 486 CPU-SX, DX, DX2... all the way to the 1993 super OverDrive processor based on Intel's Pentium™ architecture. Just pop the upgrade into our Low Insertion Force socket, change settings and go!
- Latest 32-bit chipset with 256K write-back cache for ultra high performance.
- Includes 2 serial, 1 parallel and 1 game port and support for 2 floppy and 2 IDE hard drives built into the motherboard. No switches or jumpers! It's entirely configurable through the BIOS.
- Up to 32 MB's of high speed memory.
- VESA local bus slot is compatible with any industry standard video card.

Lightning Video Family!

Select from our line of superfast VESA Local Bus video cards, up to 65 MM Winmarks!

Get Horizontal...

Our standard desktop systems feature a rugged plastic-over-steel construction with 'one screw' assembly for quick 'n' easy upgrades. It supports 3 accessible 5.25" and 2 internal 3.5" drive bays.

intel inside

Get Vertical...

Our mini-tower offers an amazing 6 drive capacity: 4 external plus 1 internal 5.25" unit and 1 internal 3.5" unit, all in a miniscule 8" x 16" footprint for only $100 more.

*††Features only one floppy drive of your choice and standard 486 motherboard. The Local Bus is optional at an additional cost. *Leasing arranged through Leasing Group, Inc., payments based on 36 month open-end rate. Intel™ 386, 486 and Intel Inside logo are trademarks of Intel Corp. ™/® Trademarks belong to their registered owners. Prices and specifications subject to change without notice. †Within 100 miles of any Dow Jones Service Center Quotes: Computer Buyer's Guide & Handbook Nov. 1992, p.96, PC World Dec. 1992,p.155. **Must be returned 'as new' in original packaging. Compudyne Direct, 15167 Business Ave., Dallas, TX 75244*

Paying A Premium For It Isn't.

DESKTOP	CPU/RAM	HD	VIDEO BOARD/MONITOR	PRICE
486SX/25††	Intel 80486SX-25 MHz, 8K CPU Cache/ 4 MB	80	16-bit SVGA card/ 14" 800x600 VGA color monitor	**$999** $37/mo.*
486SX/33††	Intel 80486SX-33 MHz, 8K CPU Cache/ 4 MB	120	16-bit SVGA card/ 14" 1024x768 SVGA color monitor	**$1199** $44/mo.*
486DX/33 Cache	Intel 80486DX-33 MHz, 128K CPU Cache/ 4 MB	170	*All these systems come with:* 16-bit True Color SVGA Windows accelerator card with 1 MB RAM/ 14" 1024 x 768 SVGA .28 Dot Pitch non-interlaced color monitor	**$1599** $59/mo.*
486DX2/50 Cache	Intel 80486DX2-50 MHz, 128K CPU Cache/ 4 MB	200		**$1799** $67/mo.*
486DX/50 Cache	Intel 80486DX-50 MHz, 128K CPU Cache/ 4 MB	200		**$1999** $74/mo.*
486DX2/66 Cache	Intel 80486DX2-66 MHz, 128K CPU Cache/ 8 MB	340		**$2399** $93/mo.*

ALL NEW PRICES!

Unparalleled Flexibility...

Pick a pre-configured PC or configure your own! Every Compudyne system includes:

- 1.2 and 1.44 MB floppy drives
- RAM expandable to 32 MB
- 6 I/O board slots
- Built in serial (2), and parallel (1) and game (1) ports
- 200 watt power supply
- 101 AT-style keyboard
- Latest version of Microsoft® MS-DOS and Windows
- Microsoft compatible serial mouse
- U/L listing
- FCC certification

Choose From More Fun Stuff:

- *Displays:* Mono or Color VGA; 1024 and 1280 interlaced or non-interlaced; 14", 15", 17" and 21".
- *Hard Drives:* 40; 80; 120; 170; 200; 340; 535; 680 MBs or 1.2 GBs and larger.
- *Complete multi-media kits:* Including CD-ROM, Sound board, speakers and tons of software.
- *Internal FAX/Modem:* 9600 bps send/receive fax; 2400 bps modem; including WinFax or Quicklink Software.
- *And much, much more...* we stock over 5,000 name brand products!

Meet The Press:

"Our Real World Benchmark confirm that the Compudyne is one of the fastest 486 computers we have ever tested."

486DX 2/66 November '92

"...Our overall Best Buy is the 486SX/25 from Compudyne. It managed to balance both speed and price...it also scored well on design, and its service and support was good."

486SX/25 Best Buy December '92

YOU CAN ALSO BUY THESE NEAT PRODUCTS EXCLUSIVELY AT COMPUSA

Dial To Save Dollars
1-800-932-COMP
In Canada: 1-214-702-0055
24 hour fax: 1-214-888-5743

COMPUDYNE

THE LOWEST OF THE LOW PRICES. GUARANTEED.

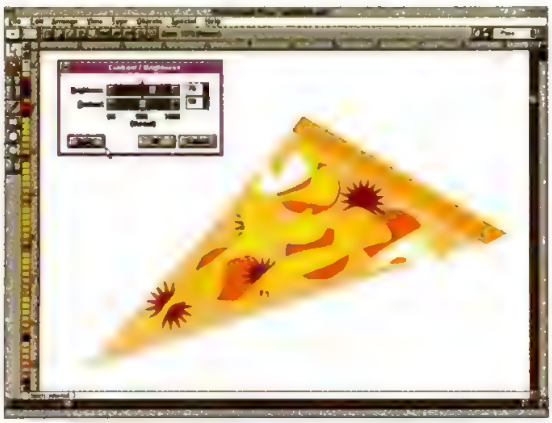
HOURS OF OPERATION
7am-10pm (CDT) Mon.-Fri.
9am-5pm (CDT) Sat.

WARRANTIES
*30-day, no questions asked, return policy.***
1 year limited warranty.

SUPPORT
Toll-free technical support
On-site service for desktops'

PCM0333

CIRCLE 357 ON READER SERVICE CARD



Professional Draw allows you to adjust the brightness and contrast of colors, a unique feature not found in other illustration programs.

allows you to cut any object as if you were using scissors. You can fill open curves without having to first close them—a real time-saver. In addition, you can draw stars or polygons by specifying the number of segments, and the Library feature makes it easy to reuse pieces of graphics as well as to drag images from the Library window onto the page.

But once you go beyond the basics, Professional Draw has a depth and complexity than can be daunting. There are two or more versions of every tool; some tools also have an additional button offering up to six more options, each of which may offer even more choices. For example, you can draw an arc three different ways, and two of those ways have four additional drawing methods.

There are modifiers that constrain the drawing, transforming, reshaping, and moving of objects, and there are five transformation buttons, all of which change the way each tool works. The arrow tools are also exceptional; you have a multitude of choices and can manipulate the size of the arrow interactively. These myriad tools can make complex tasks simpler—if you can understand the completely new concepts behind them, which steepens the learning curve.

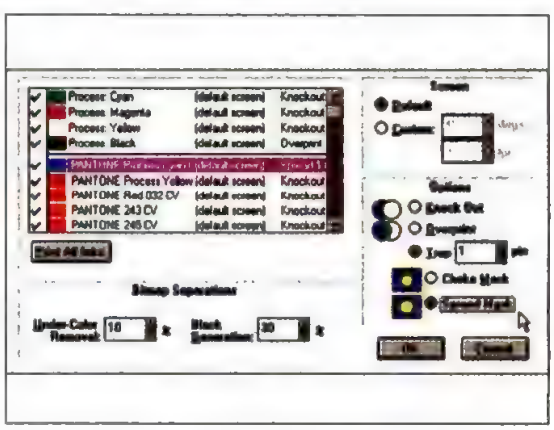
A lack of context-sensitive help exacerbates the problem. Hitting F1 does nothing from within dialog boxes, and the on-line help often neglects the basics. For example, the Help system refers to a Text Block dialog box but does not explain how to locate it. Since the dialog does not appear on a menu and is not accessible by double-clicking the text tool (as with some other tools), only experimentation will reveal that double-clicking on the text block itself brings up the well-hidden menu. A new program with so many new concepts and features needs to take special care in teaching users. Professional Draw doesn't.

styles, and arrows. In addition, you're given a choice of tints when you select colors from the on-screen color bar.

Unlike other programs, Professional Draw lets you place multiple colors in a single gradient; sliders let you move those colors along the gradient. You can even change the size and angle of the gradient over the object.

Printing separations is another area where Professional Draw shines. Any ink can be globally overprinted or knocked out. You can create chokes or spreads with spot colors, and 24-bit color boards are widely supported. Professional Draw's EPS export allows you to embed 300-dpi color TIFF headers that print sharply even on non-PostScript printers. (This makes the EPS file larger, but many applications will only print the TIFF header on non-PostScript devices.) Yet, despite all this, there is absolutely no color calibration, so you can't really be sure that the color you see on-screen is the color you'll get on paper.

Professional Draw gives you a variety of options when it comes to text. The program is equally adept at handling short blocks of text for headlines and effects and long blocks of paragraph text. The long blocks can be linked with text flowing from block to block and page to page, and long blocks can also be set in one of 16 different shapes. But paragraph text cannot be rotated, which can be a severe design limitation. While there are controls for leading, tracking, and even compression and expansion, there is no setting for word spacing.



Professional Draw includes global controls for overprinting and knockout, and trapping, choking, and spreading for spot colors, with under-color removal and black generation for bitmaps.

COLOR POWER

Professional Draw's color handling is one of its greatest strengths. It's the only illustration program that allows you to adjust the colors of objects by brightness, contrast, or color balance. You can use this ability to find the right colors for highlights by adding more brightness instead of mixing colors. You can choose to see only the colors already used in your document, select objects on any given layer by spot color, or use the Style feature to add consistency to fills, strokes, colors,

FACT FILE

Professional Draw, Version 1.0a

Gold Disk Inc., Box 789, Streetsville, Mississauga, Ontario L5M 2C2, Canada; 416-602-4000; fax, 416-602-4001

List price: $595.

Requires: 286-based PC or better (386 recommended), 4.5MB hard disk space (18MB recommended), VGA display or better, DOS 3.3 or later, Microsoft Windows 3.x, mouse or tablet.

In short: Professional Draw sports numerous innovative features not found in other illustration programs. Its exceptional color handling, smooth extrusions, multiple pages, and linked paragraph text boxes in irregular shapes make it a powerful program. Unfortunately, Professional Draw is marred by the omission of basic features such as color calibration, lack of context-sensitive help, and problematic font handling.

472 ON READER SERVICE CARD

Professional Draw handles TrueType and type-scaler–enabled Type 1 fonts and accepts CorelDraw .WFN fonts (though not always fonts converted with WFNBoss). In addition, the package includes its own internal Type 1 rasterizer for those lacking ATM.

All these fonts are not as useful as they might be, though. Despite a 1.0a update, which corrects many bugs, Professional Draw would only recognize 188 of the 320 fonts on the system, and only 18 of the 156 ATM fonts installed. The problems corrected by the update include the previous inability to access high-ASCII characters, such as typographic quote marks, and the limit of 255 fonts on a system (now there's just a limit of 255 fonts per document).

Professional Draw is the only illustration program that allows you to adjust the colors of objects by brightness, contrast, or color balance.

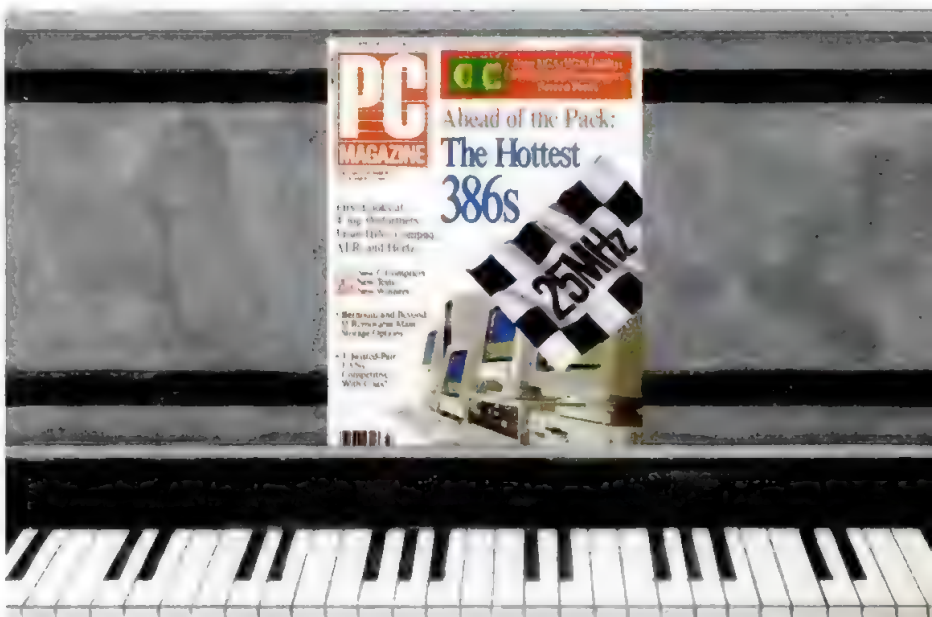
The package suffers from some other shortcomings, too. You can hide or gray out lower layers; however, you cannot select objects across layers, which can make it extremely difficult to effect global changes, such as size or position, in complex illustrations. Furthermore, you must constantly change to the correct layer, and each time you do, the screen redraws, taking time. And while the package supports a good number of imports, it offers only limited exports. .WMF export is adequate, but CGM export is poor; the autotracing is very slow and doesn't support Centerline. In addition, the entire screen redraws every time you paste an object.

Professional Draw has some of the most powerful and innovative new features in the world of illustration programs. Some users, however, may find the awkward interface makes the whole of the program sometimes feel less capable than the sum of its many exceptional individual parts. □

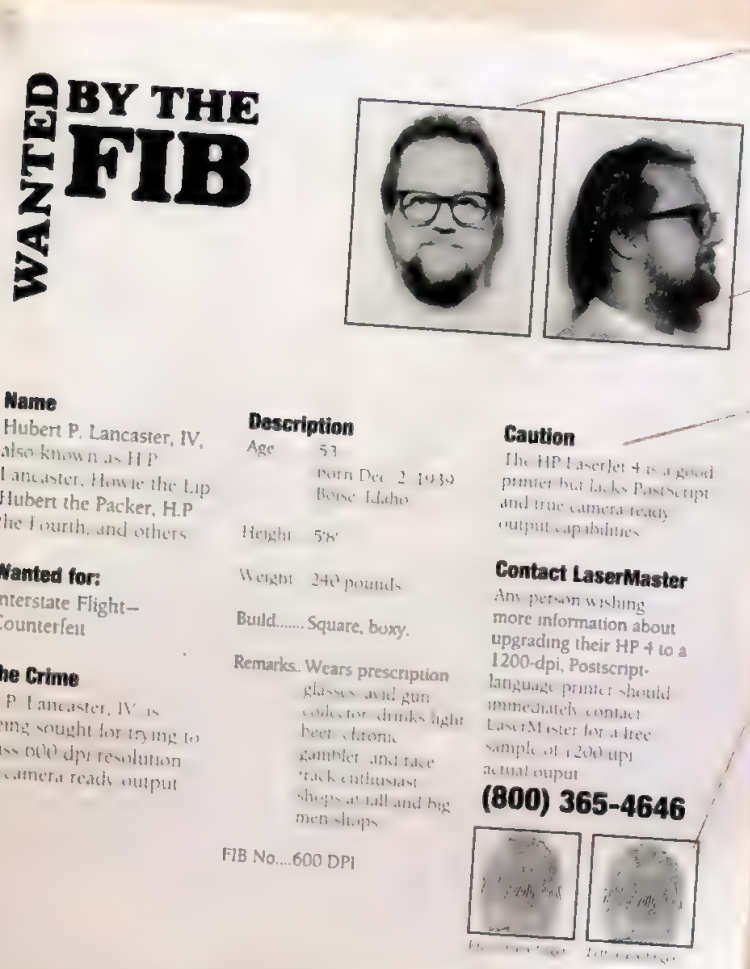
Play It Again... Sam.

Don't allow your excellent review to fade away like a golden oldie. Ziff-Davis can print custom-designed article reprints* to keep your product at the top of the hit parade. Call today for information: Claudia Hardison, Reprints Manager, 212-503-5447.

*minimum quantity 500; 3 to 4 weeks delivery.



Some people just don't appreciate 1200-dpi PostScript™ output.



The WinJet™ 1200 upgrades a Hewlett-Packard® LaserJet® 4 to print with 1200-dpi PostScript-language output for camera-ready halftones that reveal details like scars and birthmarks. With output this sharp, everyone will take a closer look at your work!

ENHANCED PRINTING FOR WINDOWS

The WinJet 1200 produces 25 halftone screen frequencies between 50 and 150 lines per inch. The HP® LaserJet 4M only provides six.

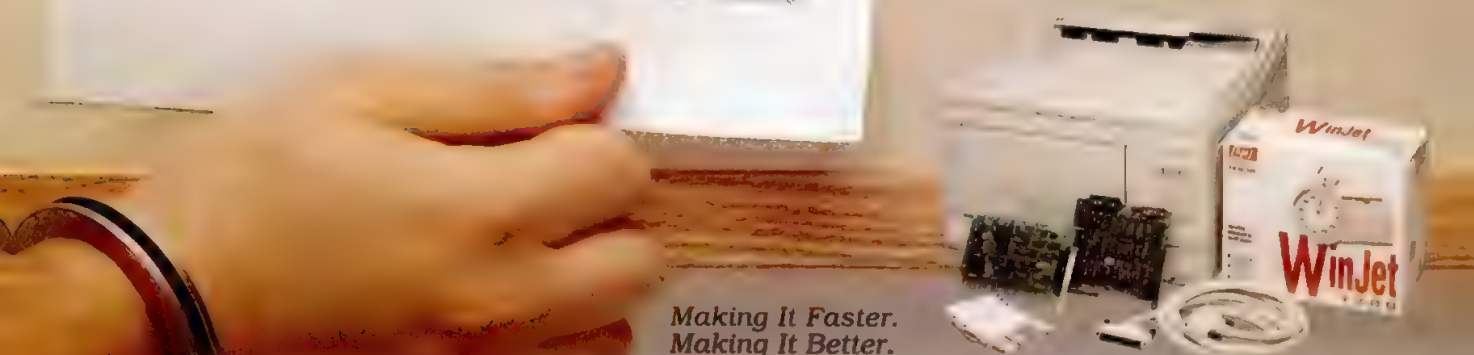
You need 1200-dpi resolution to guarantee that your text and line art are camera-ready quality. Even at 600-dpi, the LaserJet 4 can't make that guarantee.

The WinJet 1200 uses TurboRes® to show even the finest details accurately.

HP Printer UPGRADES	Resolution	Max. Paper Size	Price
WinJet 1200[1]	1200 dpi	8.5" x 14"	$995
WinJet 800[2]	800 dpi	8.5" x 14"	$495*
Windows PRINTERS	**Resolution**	**Max. Paper Size**	**Price**
WinPrinter 600XL	600 dpi	11" x 17"	$3695
WinPrinter 800	800 dpi	8.5" x 14"	$1095*
WinPrinter 360XLS	360 dpi	17" x 22"	$1795

[1]Upgrades an HP LaserJet 4. [2]Upgrades an HP LaserJet II, IID, III, IIID

*SPECIAL LIMITED TIME PRICE



Making It Faster. Making It Better.

LM LASERMASTER
WINPRINT PRODUCTS DIVISION

DISCOVER VISA MasterCard

Call for more information or for the dealer nearest you: **1-800-365-4646** or 612-944-9330 Fax: 612-944-9519 Dept. 33E

©1993 LaserMaster Corporation, 6900 Shady Oak Road, Eden Prairie, MN 55344. The LM logo and LaserMaster are registered trademarks, and WinPrint and WinJet are trademarks of LaserMaster Corporation. This product incorporates Truelmage v 1 software with LaserMaster enhancements for performance and resolution. HP and LaserJet are registered trademarks of Hewlett-Packard Corporation. PostScript is a trademark of Adobe Systems, Inc. Windows and Truelmage are trademarks of Microsoft Corporation. TrueType is a trademark of Apple Computer, Inc. All other product or brand names are trademarks of their respective holders. WinJet 1200 system requirements: 386DX or 486 with 16 MB of RAM. Specifications and prices subject to change without notice. 1/93

CIRCLE 237 ON READER SERVICE CARD

Measuring a String

BY NEIL J. RUBENKING

MEASURING A STRING

A while back (User-to-User, September 24, 1991), you presented a reader's contribution—GETLEN.BAT—that could determine the length of a string of up to eight characters in DOS. Inventive as it was, a simpler method exists—one that sidesteps the need to create dummy files and directories.

The original GETLEN.BAT batch file works because DOS truncates filenames that are longer than eight characters. My approach uses the operating system's inability to accept more than 127 characters on the command line. The file looks like this:

```
rem @echo off
REM Next line contains 87 x
 characters
if not "%1"=="" getlen1 xxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxx%1 8 7 6 5 4 3 2 1
set N=0
```

Line three checks for the presence of a command parameter and, if found, concatenates it to a filler string (mine is the letter *x* 87 times), tacks on a space/digit pair for each of the numbers 8 through 1, and then passes the result to GETLEN1. It seems as if this line (when processed by DOS) should grow by two characters for every one in GETLEN's first parameter, since the %1 occurs twice. But in reality, input to GETLEN containing only one character causes the line to hit the DOS length limit, and each succeeding input character pushes two off the line's end. Thus, the number of parameters sent to GETLEN1 depends on the length of the input string.

Suppose the input contains one character—the dollar sign, for example. GETLEN1.BAT would receive a dummy first parameter of 88 characters (87 repetitions of *x*, then a single $ symbol) followed by the numbers 8 7 6 5 4 3 2 1. (Note that a space precedes each of these numbers, including the 8). An input of eight characters, however, would send GETLEN1.BAT a 95-character dummy first parameter (87 plus 8) followed by a space and the number 8. For an original string longer than 8 characters, GETLEN1.BAT receives only the dummy.

GETLEN1.BAT looks like this:

```
for %%f in (10 %2 %3 %4 %5 %6 %7
 %8 %9) do set N=%%f
```

Assuming an input string was present on the GETLEN command line, the FOR command sets the length variable *N*, which first takes on the value 10, then, starting at 8, works its way as far down as 1 depending on the number of parameters passed from GETLEN. An eight-character input string produces two iterations (*N*=10 and *N*=%2, which would be the number 8), while a one-character input results in 9 repetitions of the for statement (*N*=10, *N*=%2 . . .*N*=%9). An overflow leaves *N* set to 10. If no input string exists on the GETLEN command line, GETLEN.BAT sets *N* to 0 without calling GETLEN1.BAT.

Van Smith
Bethesda, Maryland

The 127-character limit for a DOS command line or batch lines is normally an annoyance. But the clever batch file presented here can turn this into an advantage.

IN THIS SECTION

Tutor 311
Utilities 314
Environments 322
Power Programming 329
Solutions 344

▶PC MAGAZINE: The 127-character limit for DOS command lines and batch lines is normally an annoyance. How clever to turn it into an advantage! Remember that the 127-character limit applies *after* all environment variables, command line parameters, and FOR variables have been replaced by their values. The line (which I've slightly altered) as shown in Figure 1 is 129 characters long. Suppose the first input parameter is a single A—the two occurrences of %1 will be replaced by A, reducing the line to an acceptable 127 characters and allowing all of the numeric parameters to reach GETLEN1.BAT (Figure 2). If the input is AA, however, the line becomes longer than 127 characters, so the 1 is chopped off. If AAA is input, both the 1 and the 2 get the ax. Each additional character in the input string causes one more number to be snipped off. The *last* number always gives the length of the input string.

I took the liberty of modifying the original GETLEN and GETLEN1 batch files to report lengths from 0 to 10 instead of 0 to 8. A value of 10 means the length was 10 *or more*, not that it was precisely 10. GETLEN.BAT is limited to passing single-digit length values as parameters to GETLEN1.BAT since, for the line to be properly truncated when it's formed, each of these values must occupy precisely two characters. Also, GETLEN1.BAT can only handle nine parameters (which is the maximum DOS will accept in a single statement), since it uses all nine at once in its FOR loop. With a little enhancement, though, this technique can report lengths up to 38 characters.

Figure 3 shows GETLENX.BAT, an adapted version of GETLEN.BAT that uses two-digit numbers as numeric pa-

Introducing a New Breed of Programming Book

ISBN: 1-56276-059-9
Price: $29.95

ISBN: 1-56276-063-7
Price: $29.95

Ziff-Davis Press proudly introduces the Lab Notes series by presenting two new titles: *PC Magazine Assembly Language Lab Notes* and *PC Magazine C Lab Notes.*

These specially designed book/disk packages give programmers a unique opportunity to learn the programming secrets of acknowledged masters. Bolster your skills and solve both common and uncommon problems as you join the authors in systematically creating a fully functional utility in every chapter.

What's more, because each sample program is included on the bound-in companion disk, you can concentrate on nuts-and-bolts programming instead of keying in lines of code.

Join the masters at work and achieve new heights of programming power and elegance with the Lab Notes series from Ziff-Davis Press.

In the future, look for books on BASIC and DOS Batch Files.

Available at fine bookstores, or call

1-800-688-0448

ext. 8410

© 1992 Ziff-Davis Press

GETLEN.BAT

Complete Listing

```
@echo off
REM Next line contains 85 x characters
if not "%1"=="" getlen1 xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx%1 9 8 7 6 5 4 3 2 1
set N=0
```

Figure 1: **This batch file finds the length of an input string, from 0 to 9 characters.**

GETLEN1.BAT

Complete Listing

```
SHIFT
for %%f in (10 %1 %2 %3 %4 %5 %6 %7 %8 %9) do set N=%%f
```

Figure 2: **This batch file is called by GETLEN.BAT; the last parameter GETLEN1 receives is the length of the input string.**

GETLENX.BAT

Complete Listing

```
@ECHO OFF
REM GETLENX.BAT - Get length of string up to 38 chars
IF '%1'=='' GOTO None
GETLEN1X x%1%1%1 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22
 21 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03 02 01
:None
SET N=00
```

Figure 3: **This variation of GETLEN.BAT can find string lengths up to 38 characters.**

GETLEN1X.BAT

Complete Listing

```
@ECHO OFF
REM GETLEN1X.BAT - used by GETLENX.BAT
SET N=overflow
:Loop
SHIFT
IF '%1'=='' GOTO OutOfLoop
SET N=%1
GOTO Loop
:OutOfLoop
```

Figure 4: **The *last* parameter received by GETLEN1X.BAT is the length of the string passed to GETLENX.BAT.**

rameters. GETLENX.BAT first tests for the presence of a parameter on its command line, jumping to the label None if it finds nothing. Otherwise it executes GETLEN1X.BAT (Figure 4), passing a first parameter that consists of an *x* plus *three* copies of the command line parameter, followed by the numbers from 38 down to 01. Each character in the input string causes the dummy parameter to lengthen by three (due to the term %1%1%1). When forming the line that gets passed to GETLEN1X.BAT, we want every input character to eliminate one numeric parameter, which explains why each number occupies three places (a space and two digits). As before, the command gets cut off at 127 characters. The *last* numeric parameter remaining gives the actual string length.

Since GETLEN1X.BAT receives and must process more than nine parameters, it uses a SHIFT command to simply flip through them, setting the environment variable *N* to each one in turn. If the actual parameter is *longer* than 38 characters, GETLEN1X.BAT will receive nothing but the first—in which case it sets the *N* to the string "overflow."

This is an ingenious technique—I'm still pondering what other problems might be solved by turning the 127-character limitation into an asset.

You can download all files mentioned in this column from the Utilities/Tips Forum on PC MagNet, archived as GETLEN.ZIP. □

Share your latest DOS and system discoveries through User-to-User. See the "How to Contact Us" sidebar in the Solutions column.

TUTOR

Viruses: How They Work and How to Avoid Them

BY JEFF PROSISE

If you've ever encountered a virus on your computer, you know it's not fun. Even viruses that don't damage your system—viruses that throw a message up on your screen or play a tune—can waste your time, use valuable RAM, and slow down your system. U.S. businesses spend millions of dollars a year defending against and recovering from virus attacks.

I didn't give viruses much thought until this past spring when I encountered the Stoned virus. But since then I've been on guard. So when Jim Ralph, director of quality assurance at Gibson Research (makers of SpinRite II), mentioned that he had dissected the Michelangelo virus (the infamous virus that received so much press early last year) and asked if I'd be interested in seeing the commented source code listing, I didn't hesitate to say yes. A prerequisite to formulating a plan for combating viruses is understanding how they work, and what better way is there to learn how they work than examining the most famous virus of all.

I won't reproduce the source code for Michelangelo here. Doing so would border on the irresponsible, because it would place in the public domain a means to produce more sinister strains of Michelangelo. What I will do is summarize the different types of viruses, then give a blow-by-blow account of how the Michelangelo virus works and how it spreads itself to other systems. At the end, I'll wrap up with a few common-sense tips for avoiding virus attacks.

THE TWO TYPES OF VIRUSES While there are many varieties, computer viruses on the IBM PC can usually be divided into two categories: viruses that infect executable files and viruses that infect the system area of a disk—the boot sector on floppy disks and the master boot record on hard disks. The latter type of viruses are often referred to as *boot sector viruses* or *partition table viruses.*

The first kind of virus typically attaches itself to an .EXE or .COM file. *Attach* in this sense means that the virus searches out a .COM or .EXE file on-disk and physically adds itself to the file. This increases the file length, which is one clue that a virus has infected an executable file. When the program file is run, the virus loads itself into memory where it can actively spread the infection to other executable files. It's relatively simple to concoct a virus that attaches itself to a .COM file, and only a little more work to write one that attaches itself to .EXE files.

The second kind of virus attacks the boot sector of a floppy disk or the master boot record of a hard disk. The *boot sector* is the first sector on a DOS-formatted disk; it holds the bootstrap code that loads DOS into memory. The *master boot record* is the code that reads a hard disk's partition table, locates the boot sector of the bootable partition, and then executes the bootstrap code in the boot sector. In either case, the virus copies the bootstrap code in the boot sector (floppy disks) or the code contained in the master boot record (hard disks) to another location on the disk, and replaces the original code with code that loads the virus and then executes the code that was saved away earlier. Thus, start-up proceeds as normal, but the virus is loaded into memory before the operating system. Once the virus is resident in memory, it monitors disk activity and infects other disks—hard disks and floppy disks—when it can.

The term *partition table virus* is actually something of a misnomer. On a hard disk, the master boot record is stored in the same sector—the first physical sector on the disk—as the partition table, leading some to call viruses that infect the master boot record "partition table viruses." In fact, the virus doesn't affect the partition table at all; it only affects the master boot record. Floppy disks don't contain master boot records or partition tables, so viruses go directly to the boot sector, which is as easy to locate on a floppy disk as the sector containing the master boot record is on a hard disk.

THE MICHELANGELO VIRUS Michelangelo is perhaps the best known computer virus. Sometime during the months leading up to March 1992, word leaked to the press that Michelangelo had quietly spread to thousands (by some accounts, millions) of PCs around the world; on March 6, the artist Michelangelo's birthday, the virus would spring to life and overwrite the data stored on infected hard disks. Thanks partly to the publicity that surrounded the virus, the actual number of Michelangelo attacks was substantially less than anticipated. In some ways, Michelangelo even had a positive effect: It increased general awareness about the threat of computer viruses.

Michelangelo is a boot sector virus. The only way you can get it is to boot your PC with an infected floppy disk in drive A:. But the infected floppy disk in drive A: doesn't have to be a bootable disk. If you leave a disk in Drive A: and it happens to be infected, when you reboot, the bootstrap program will run and unknowingly put the virus into memory before you get the "Non-System disk or disk error" message. Once Michelangelo infects the master boot record of your hard disk, the virus is quietly loaded into memory every time you boot from your hard disk. Once it is resident in memory, Michelangelo spreads itself by checking every disk you place in the A: drive and infecting the boot sector of floppy disks that aren't already infected.

When Michelangelo infects a floppy disk, it copies the floppy disk's existing boot sector to the last sector of the root directory and then replaces the start-up code in the boot sector with the viral code. (A certain number of sectors on every disk are reserved for the root directory; the number of reserved sectors depends on the disk's formatted size.)

When you boot from the disk, the viral code in the boot sector gains control. First, it retrieves the word value at absolute address 0040:0013, which specifies how many kilobytes of conventional memory are present, and subtracts 2 from it to make it appear that the PC has 2K less RAM than it really has. Then it copies itself into the upper 2K of RAM that now is hidden from the rest of the system. (That's why Michelangelo doesn't show up in DOS's chain of memory control blocks as other TSRs do; as far as DOS is concerned, the memory where Michelangelo resides doesn't exist.) Second, Michelangelo patches the interrupt 13h vector in low memory to point to one of its own routines. Interrupt 13h is the gateway to the BIOS disk services; by tapping in to this interrupt, Michelangelo can monitor all disk activity in the system.

Now Michelangelo reads the hard disk's master boot record to see whether it is infected. If the hard disk is free of infection, Michelangelo infects it. It first calls a routine that copies the original master boot record to an unused location on the disk (an empty sector between the first sector on the disk—the one that contains the master boot record and the partition table—and the beginning of the first partition). Then it overwrites the master boot record with viral code and links the new master boot record to the old so that both will be executed the next time the PC is started. The partition table itself is left intact, so you can't tell that the hard disk is infected solely by inspecting the partition table. The next time the system is booted from the hard disk, Michelangelo will be loaded into memory just as it was when the system was booted with the infected floppy disk.

Once Michelangelo is resident in memory, it intercepts all interrupt 13h calls to read, write, or otherwise access the disk in drive A:. When a call is intercepted, the virus checks to see whether the disk is infected with the virus. If it is, Michelangelo hands over the request to the original BIOS interrupt 13h. If the floppy disk is not infected, Michelangelo patches the call through to the BIOS and then reassumes control of the system when the call returns.

When the call returns, Michelangelo infects the floppy disk by copying the original boot sector to the final sector of the root directory and then copying itself to the boot sector. As a precautionary measure, Michelangelo only infects the floppy disk if the drive motor is on, which the virus can determine by inspecting bit 0 of the byte at absolute address 0040:003Fh. Not all calls to interrupt 13h cause the drive motor to come on and the disk to start spinning. By checking the drive motor before acting, Michelangelo ensures that the drive light won't come on for no apparent reason and alert you to the presence of a virus.

Thus, the circle is joined. You got the virus when you tried to boot from an infected floppy disk in Drive A:, the virus copied itself from that disk to your hard disk, and now it will infect other floppy disks that you place in drive A:. These disks, in turn, may infect other systems, and the virus will spread exponentially.

Each time it starts up, Michelangelo calls interrupt 1Ah, function 04h to retrieve the current date from the BIOS. If DX returns 0306h (Month=3 and Day=6, or March 6), the virus invokes an internal subroutine that trashes the disk you booted from. This routine destroys data on the disk by repeatedly calling interrupt 13h, function 03h (the BIOS Write Disk Sectors function) to copy random data from memory to disk, alternating drive heads as it goes to make sure the destruction is thorough. By the time you realize something is amiss, the system area of the disk will be mangled. Even a full backup of the files on your hard disk isn't sufficient to undo the destruction; you'll need a backup of the partition table, too. If you're a DOS 5.0 user, you can copy the partition table to a floppy disk with the MIRROR /PARTN command. If you don't have a backup of the disk's partition tables, you can repartition the disk with FDISK.

Michelangelo is far from perfect. One tipoff that it's present is that CHKDSK or MEM reports 2K less conventional memory than the amount that is physically installed.

Michelangelo is easily eradicated from hard disks by refreshing the master boot record and rebooting. If you use DOS 4.*x* or DOS 5.0, you can use FDISK's undocumented /MBR switch to write a new copy of the master boot record to your hard disk. The /MBR switch was discussed in the September 15, 1992, Tutor column.

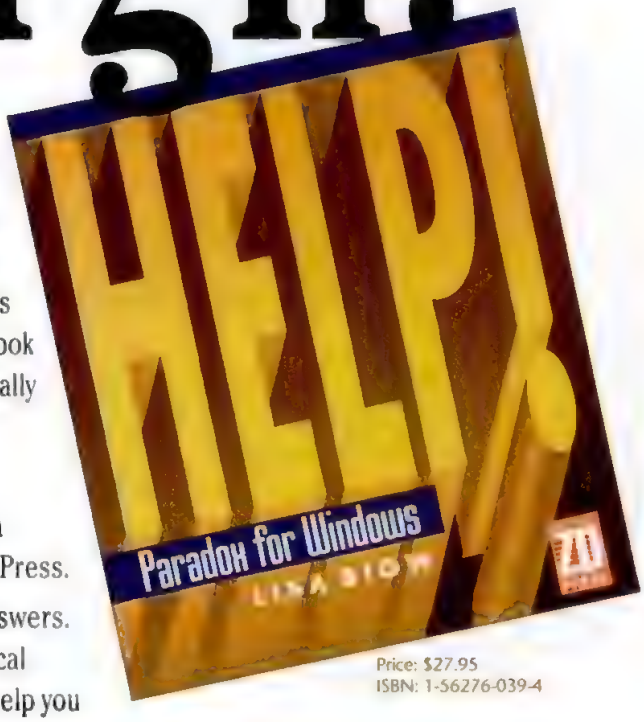
Other viruses aren't so easily removed. The Joshi virus, for example, intercepts calls to interrupt 13h and silently foils attempts to refresh the master boot record. FDISK /MBR appears to work, but in fact it does not. Worse, if a program tries to read the sector that contains the hard disk's master boot record, Joshi intercepts the request and directs the program to the copy of the original master boot record filed elsewhere on disk. About the only way to eradicate Joshi on a hard disk is to boot from a fresh, virus-free floppy disk so that the viral code never gets a chance to take hold. Then use FDISK /MBR to refresh the master boot record and wipe out the virus.

AVOIDING VIRUS ATTACKS So how do you avoid virus attacks? Some of this is old news, but it bears repeating. First and foremost, be careful about the floppy disks you place in your PC. If you don't know where a disk came from, be wary of it. If a floppy disk has a boot sector virus and you forget to remove it from your floppy disk drive and boot your machine, the virus will spread—even if it's not a bootable floppy disk. However, infected executables will only spread a virus if you execute them.

Also, be suspicious of programs handed to you by friends or downloaded from bulletin boards whose operators do not routinely scan for viruses.

Second, be diligent in scanning your system for viruses. There are several commercial and shareware antivirus programs available. The cost of a good antivirus utility will almost assuredly be less than the cost of replacing data destroyed in a virus attack. MS-DOS 6.0, which should be nearing release by the time you read this, will have antivirus capabilities built in. We'll discuss the MS-DOS antiviral aids in a future column. □

Arrrgh!



Price: $27.95
ISBN: 1-56276-039-4

Don't you just hate it when software doesn't work the way you expect? When simple problems block your progress for hours? When your resident techie isn't around, the technical support hotline is constantly busy, on-line help is no help at all, the manual is hopeless, and the book you have tells you everything except what you really need to know?

Don't you just hate it?

We do too. That's why we developed ***HELP!***, a groundbreaking series of books from Ziff-Davis Press.

HELP! books mean fast access to straight answers. If you're a beginner, you'll appreciate the practical examples and skill-building exercises that will help you work confidently in no time. If you're already an experienced user, you'll love the comprehensive coverage, highly detailed indexes, and margin notes and sidebars that highlight especially helpful information. And ***HELP!*** books are great troubleshooting guides for all users because our authors have access to thousands of tips and work-arounds compiled by *PC Magazine*, *PC/Computing*, and other Ziff-Davis magazines.

We're launching the ***HELP!*** series with these all-new books:

HELP! Paradox for Windows—Popular database and spreadsheet authority Lisa Biow provides one-stop solutions to the challenges of Borland's high-powered new database manager.

HELP! Microsoft Access—Best-selling author Miriam Liskin gives you fast access to the complete feature set of Microsoft's leading-edge Windows database program. Sample databases included on disk!

Price: $29.95
ISBN: 1-56276-099-8
Available: April 1993

More ***HELP!*** is on the way soon for WordPerfect for DOS, WordPerfect for Windows, Word for Windows, and NetWare 4.0.

So if you hate struggling with software as much as we do, visit your favorite bookstore and just say ***HELP!***

ZIFF DAVIS ZD PRESS

CIRCLE 354 ON READER SERVICE CARD

© 1993 Ziff-Davis Press

Available at fine bookstores, or call toll-free 1-800-668-0448, ext. 71.

Quick-Boot Your PC and Protect Your Data with BOOT2C and BOOTPW

BY DOUGLAS BOLING

How often do you forget that you've left a floppy disk in drive A: when you boot up your PC? Don't you wish that instead of giving you an annoying "Non-System disk or disk error" message and making you unlock drive A:, your machine would simply go to drive C: and boot up from there directly?

BOOT2C, the first of this issue's two utilities, eliminates the forgotten-disk syndrome. By installing a tiny bit of code in the boot sector of the drive A: floppy disk, BOOT2C automatically forces the machine to load the operating system files from the hard disk. BOOT2C does this not only for DOS-based PCs, but for machines that run under OS/2 as well.

Indeed, with a BOOT2C-modified disk in drive A:, your machine will actually boot faster. That's because your PC won't receive and process an error when it attempts to read the A: drive. Normally, a PC retries its initial floppy disk read up to five times before giving up and booting from the hard drive.

If you're running under OS/2, BOOT2C can actually redirect its boot-up instruction to another physical disk—drive D:, for example. Unfortunately, current releases of DOS don't support this feature, but in a future DOS version you may not have to be limited to booting from drive A: or C:.

The second utility presented in this issue is BOOTPW, a program that will password protect either a floppy or a hard disk. Once protected, the disk won't be recognized as a valid disk by either DOS or OS/2.

You won't subsequently need the BOOTPW program to unprotect the disk. Just start the machine with the password-protected floppy disk in the A: drive, and the BOOTPW code will ask for the proper password. Note that once the password is entered, the protection is removed; to reprotect the disk BOOTPW must be reinstalled.

If you are interested in the two utilities presented in this issue, you can download both along with their assembler source code from the Utilities/Tips Forum on PC MagNet. Look for BOOT2C.ZIP and BOOTPW.ZIP. The "Utilities by Modem" sidebar contains the necessary information for downloading the utilities.

Boot2C lets you leave a disk in drive A: and still boot from your hard disk, while BootPW provides operating system password protection.

If you don't have a modem, BOOT2C and BOOTPW are also available directly from *PC Magazine*. Send a *postcard* with your name, address, and floppy disk preference (360K, 720K, 1.2MB, or 1.44MB) to the attention of Katherine West, *PC Magazine*, One Park Ave., New York, NY 10016-5802. No phone calls, please!

USING BOOT2C BOOT2C is a simple program with a simple interface. Its full syntax is

```
BOOT2C d: [n]
```

where *d*: is the disk drive on which the redirection code is to be installed and the optional *n* parameter (to be explained below) is the number of the disk that holds the boot-up files (OS/2 only). For the normal case, assuming that the BOOT2C .COM program is on your path, you can install the necessary code on the floppy disk in the A: drive by entering

```
BOOT2C A:
```

You can then leave the floppy disk in drive A:, and you'll never have to see that irritating "Non-System disk" error message again.

The redirection code written by BOOT2C is not a file you'll find with the DIR command; it resides in the boot sector of the disk. You can write the code to a floppy disk located in drive B: by entering

```
BOOT2C B:
```

Obviously, since a PC can't boot from the B: drive, a modified disk in the B: drive won't force a hard disk boot. Such a command is useful, however, if you want to prepare the disk in your drive B: for use in another machine's drive A:. It might be, for example, that you need to put BOOT2C on a 3.5-inch floppy disk and your 3.5-inch drive is drive B:.

By using the *n* parameter, BOOT2C can also modify a floppy disk so it will boot the second hard disk of the system. By the "second hard disk" here I mean a second physical hard disk, not a secondary partition on the first hard disk. Again,

this will not work with current DOS, but OS/2 users may wish to try it. To modify a floppy disk in the A: drive to boot the second hard disk, you use the command

```
BOOT2C A: 81
```

In the above command, 81 represents the physical disk number the BIOS uses to address the disk. According to the BIOS numbering scheme, 0 is the first floppy disk, 1 is the second floppy disk, and so on. Hard disks are numbered starting with 80 hex, so the first hard disk is 80, the second is 81. Thus, to force a floppy disk in the A: drive to boot the disk in the B: drive on systems where the B: drive is bootable, the command is

```
BOOT2C A: 1
```

BOOT2C must use the BIOS number instead of the drive letter because at the point in the boot-up sequence at which the BOOT2C boot program is executed, the operating system isn't available to tell BOOT2C which physical drives it calls the A:, B:, and C: drives! The drive letters with which we are familiar don't exist at the BIOS level when a PC is booted.

Once the new BOOT2C boot record has been installed, the floppy disk will act like any other. Files can be read and written to the disk and programs executed from the disk. The only difference occurs when you boot the system with a BOOT2C-modified floppy disk in the A: drive. In that case the floppy disk displays a message indicating that BOOT2C is present and then continues by booting the files on the hard disk.

Removing BOOT2C from a disk requires executing either the DOS SYS or FORMAT commands on the disk. Although this may seem to be a drastic step to take just to remove a program, there really isn't a reason for removing BOOT2C *unless* you want to make the disk bootable. The SYS command puts the DOS system files onto the disk and replaces the boot record—including any BOOT2C code. FORMAT erases all information on the disk and writes a new DOS boot record.

USING BOOTPW Using BOOTPW is just as simple as BOOT2C. Just type BOOTPW along with the drive letter of the disk to protect. For example, to protect a floppy disk in the A: drive, you enter the command

```
BOOTPW A:
```

Once started, BOOTPW will ask you for a password. The password, which can be up to eight characters long, is not displayed on the screen as you enter it. BOOTPW then asks for the password again to ensure that you entered the password correctly. The disk should then be removed from the drive. If you now place the floppy disk in the drive again and try a DIR (or any other disk-related) command, DOS will respond with a "General failure" message.

The password protection can be removed in either of two ways. First, if you run BOOTPW on a drive that is already password-protected, BOOTPW will ask you to enter in the password for the disk. If you enter the proper password, BOOTPW will unprotect the disk, restoring it to its original state.

Since you might not always have BOOTPW available, a floppy disk can be unprotected by a second method. Simply place the disk in the A: drive and reboot your machine. Instead of booting the operating system, the disk will ask you for the password for the disk. If you enter it correctly, the password protection will be removed and the disk will continue to boot as if it had never been protected. That's to say, if the disk is not a bootable disk you'll get the standard Non-System disk error message. When this happens, all you need to do is remove the floppy disk and reboot your system.

How much actual protection does BOOTPW provide? As with all password schemes, BOOTPW *can* be broken. Its

Utilities by Modem

The *PC Magazine* utilities are available by modem from PC MagNet, a ZiffNet service hosted by CompuServe.

To find the phone number nearest you, set your communications software to 300, 1,200, 2,400, or 9,600 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex, then dial 800-346-3247 with your modem. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the number closest to you. Or you can call 800-635-6225 (voice) and follow the instructions and note the number.

To obtain the current issue's utility free of charge: Dial the local number; at the HOST NAME prompt, type CIS; and at the USER ID prompt, enter 60116,1. Then at the PASSWORD prompt, enter PCMAG UTIL.

To join ZiffNet: At the USER ID prompt, type 177000,5000. Then, at the PASSWORD prompt, enter PC* MAGNET. Finally, at the ENTER AGREEMENT NUMBER prompt, type PCMAG93.

Register your name and enter your American Express, MasterCard, or Visa number. (If you'd like to have your company billed instead, call CompuServe at 800-848-8990.) Your personal user ID and a temporary password will be displayed. A new password will arrive in the mail within ten days to confirm your subscription.

ZiffNet membership costs $2.50 per month. This includes access to *PC Magazine* Editors' Choice awards, Product Reviews Index, Weekly News from *PC Week*, Buyers' Market, ZiffNet Highlights, and the Support Forum (which also includes the current utility). CompuServe members can join by entering GO PCMAG at any CompuServe ! prompt.

Outside of these areas, PC MagNet costs $6.30 per hour for 300-bps service; $12.80 for 1,200 or 2,400 bps; and $22.80 for 9,600 bps. Billing is based on 1-minute increments.

These programs can be copied but are copyrighted. You may make copies for others as long as no charge is involved, but making copies for any commercial purpose is strictly prohibited.

protection is at the operating system level; the data on the disk is not modified in any way, and an intrepid programmer can remove the password with a few hours' work. So, using BOOTPW won't *absolutely* prevent people from reading your data, but it will deter them—at least for a while.

REVEILLE When a PC first wakes up or is reset, it goes through a built-in series of Power-On Self Tests (POST) designed to initialize the system components and ensure memory integrity. Only after the machine has been tested and initialized does it look to the outside world for a program to run. Normally, this first program is an operating system, such as DOS or OS/2. BOOTPW and BOOT2C are exceptions to the general rule, for they take control of the machine before DOS or OS/2.

To load its first program, the PC reads the first sector of the first floppy disk in the system and loads the information there at segment 0, offset 7C00 hex. If the data in that sector contains the word value AA55 hex (known as the *signature word*) at offset 510 of the block, the sector is assumed to contain valid code and the BIOS jumps to the first byte of the block (address 0:7C00). At this point, all the microprocessor registers are undefined with the exceptions of the following: the code segment register (CS), which contains 0; the instruction pointer (IP), which contains 7C00 hex; and DL, which contains the number of the drive where the boot sector was found.

If the first floppy disk sector does not have the correct signature word—because there isn't a floppy disk in the drive or there isn't a drive at all—the BIOS attempts to load the first sector of the first hard disk in the system. The process is the same as when reading the floppy disk: The first sector is placed at address 0:7C00 and the signature word is checked. If a valid signature is not found, the PC assumes that there isn't an external program to load. In this case, an IBM PC will start its ROM BASIC program. Machines that lack ROM BASIC simply wait for the user to place a proper floppy disk in the system.

The DOS boot sector has two components that are vital to DOS and OS/2 FAT drives. The first component is the BIOS Parameter Block (BPB), which is located immediately following a Jump opcode and the OEM identification field. Figure 1 shows the layout of the first 60 bytes of a DOS boot record.

The second important part of a DOS boot record is the boot program itself, which finds and loads the DOS system files. The boot program is a simple routine that uses the data in the BPB to locate the root directory on the disk. The directory is then read into memory and its entries are checked for the two DOS system programs: IO.SYS and MSDOS.SYS (for MS-DOS), or IBMBIO.COM and IBMDOS.COM (for PC-DOS). If these files are not in their proper place on the disk, the boot sector code prints its infamous "Non-System disk or disk error" message.

Using the BOOTPW program won't absolutely prevent people from reading your data, but it will deter them—at least for a while.

If these files are found, the boot routine reads the first few sectors of IO.SYS (or IBMBIO.COM) into memory and then jumps to the newly loaded code. From that point on, the machine is controlled by the DOS system programs. By using a slightly different boot program and loading the file OS2LDR instead, the machine will run OS/2 instead of DOS. In the case of the programs BOOT2C and BOOTPW, the boot record takes a different path still.

HOW BOOT2C AND BOOTPW WORK Both BOOT2C and BOOTPW work by modifying the boot record on the target floppy disk. Although both BOOT2C and BOOTPW contain code necessary for installation (and removal, in the case of BOOTPW), the replacement boot records of these programs are of primary interest.

When BOOT2C is run, it replaces the original boot record on the floppy disk with the BOOT2C boot record shown in Figure 2. Before the BOOT2C boot record is written to the disk, the fields in the BIOS Parameter Block are filled in with the information from the original boot record.

As Figure 2 shows, the boot sector

The DOS Boot Record

	Offset	Name	Size	Description
	0	jump opcode	3 bytes	Long jump or short jump followed by a NOP
	3	OEM field	8 bytes	Identifies the DOS that formatted the disk
BIOS Parameter Block	11	Bytes per sector	Word	Sector size in bytes
	13	Sectors per cluster	Byte	Number of sectors per allocation unit
	14	Reserved Sectors	Word	Number of sectors reserved after the boot record
	16	Number of FATs	Byte	Number of file allocation tables on-disk
	17	Root entries	Word	Number of entries in the root directory
	19	Total sectors	Word	Total sectors on disk 0 if number over 65,535
	21	Media descriptor	Byte	Indicates the type of media
	22	Sectors per FAT	Word	Size in sectors of each FAT
	24	Sectors per track	Word	Number of sectors on each track on the disk
	26	Number of heads	Word	Number of heads on-disk
	28	*Hidden Sectors	Word	Number of hidden sectors on-disk
Added In DOS 4	32	Huge Sectors	DWord	Total sectors if over 65,535
	34	Drive number	Byte	BIOS drive number
	35		Byte	Reserved
	36	Boot signature	Byte	Must be 29 hex for extended boot record
	37	Volume ID	DWord	Volume ID for disk
	41	Volume label	11 bytes	Copy of volume label
	52	File system label	8 bytes	Identifies file system type (FAT12 or FAT16)

* In DOS 3.3 this field was extended to a double word.

Figure 1: **This table shows the layout of the data at the start of the first 60 bytes of a DOS boot record.**

PC Magazine Utilities Updates

As with all good software, the programs presented in *PC Magazine* are upgraded and improved. Here's a partial list of the programs on PC MagNet that have been updated. To download these files from the Utilities/Tips Forum, type GO ZNT:TIPS, type LIB or select Libraries from the menu, then select Library 2 PCMAG UTILS. Type DOW and the filename listed below (for example, DOW ANSI.COM), or select Download a File from the menu.

ADDIT.COM, Version 1.1
ANSI.COM, Version 1.3
BAT2EXEC.COM, Version 1.5
BCOPY, Version 1.2
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.7
CONFIG.CTL, Version 3.0
DIRMATCH.COM, Version 3.1
EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1
PCACCESS.EXE, Version 1.1
RN.COM, Version 3.0
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
ZCOPY.COM, Version 1.4

For a list of the programs that are available on PC MagNet, download the file PCMCAT.ZIP from Library 0 (New Uploads) of the Utilities/Tips Forum.

A downloadable index to *PC Magazine*'s product reviews is also available in Library 1 (General Info). PCM.EXE is a self-extracting file containing the Computer Library *PC Magazine* Reviews Index for January 1988 through December 1991. It requires the search files that are in PCSRCH.EXE.

code is quite simple. The first instruction is the required JMP opcode. This is followed by an empty area that is filled in with the BIOS Parameter Block from the original boot record during the installation. After the BPB comes the byte that holds the drive number toward which BOOT2C will redirect the boot. The boot code that follows is relatively short and can be described straightforwardly.

First, the stack segment (SS) and stack pointer (SP) must be initialized. Since the POST procedure initializes only the CS, IP, and DL registers, all the other registers must be initialized before they are used. Once the registers are initialized, the boot code must be relocated, for the boot record that BOOT2C is to load must occupy the place that BOOT2C has taken over. BOOT2C therefore moves its own code up by 512 bytes, to address 0:7A00 hex, and then uses a far return to jump to the new location. Once relocated, BOOT2C prints a short message to indicate where it is and then proceeds to read the boot sector on the redirection disk.

Since DOS has yet to be loaded, however, BOOT2C must use the BIOS disk services. In order to read a sector via the BIOS, a program must encode the cylinder, head, and sector information in the CX and DX registers. ES:BX points to the buffer for the data and AL is loaded with the number of sectors to be read. Finally, AH is loaded with a 2 to indicate a disk read, and an Interrupt 13h is performed.

Specifically to read the boot sector of the disk, the registers are loaded so that BX contains 7C00, CX is equal to 1, DH is 0, and register DL contains the disk number.

Following the procedure of the BIOS routine, BOOT2C checks to see whether the sector read has the proper AA55 boot flag located at offset 510. If not, or if an error occurred during the read, BOOT2C displays an error message and halts the machine. If the boot record is valid, BOOT2C loads DL with the new boot drive number and jumps to the new boot code.

The boot code for BOOTPW per-

BOOT2C Boot Record


```
;*****************************************************************
;BOOT2C Boot record
; Entry:
;   CS:IP - 0:7C00h
;      DL - boot drive
;   ES:SI - Ptr to partition table boot entry (if hard disk.)
;   All other registers undefined
;*****************************************************************

;Equates for BPB addressing.  These aren't used by Boot2C

bytes_per_sec   equ     word ptr [bp+0bh]
sec_per_cluster equ     byte ptr [bp+0dh]
reserved_sec    equ     word ptr [bp+0eh]
number_of_fats  equ     byte ptr [bp+10h]
root_size       equ     word ptr [bp+11h]
total_sec       equ     word ptr [bp+13h]
media_des_byte  equ     byte ptr [bp+15h]
sec_per_fat     equ     word ptr [bp+16h]
sec_per_track   equ     word ptr [bp+18h]
number_of_heads equ     word ptr [bp+1ah]
num_hidden_sec  equ     word ptr [bp+1ch]
total_sec_long  equ     word ptr [bp+20h]
drive_number    equ     word ptr [bp+24h]
reserved        equ     word ptr [bp+25h]
extended_flag   equ     word ptr [bp+26h]
vol_serial      equ     word ptr [bp+27h]
vol_name        equ     word ptr [bp+2bh]
boot_flag       equ     word ptr [bp+3feh]      ;Offset +512 needed for code

boot_disk       equ     byte ptr [bp + offset boot_disko - offset entry]
reloc_entry     equ     offset boot_2 - offset entry
boot_initmsg    equ     7a00h + offset program - offset entry
boot_chgmsg     equ     7a00h + offset change_msg - offset entry
boot_errmsg     equ     7a00h + offset error_msg - offset entry
boot_rerrmsg    equ     7a00h + offset readerr_msg - offset entry

;-----------------------------------------------------------------
;Boot sector code
;-----------------------------------------------------------------
entry:          jmp     short boot_1
                nop
boot_data       db      64 dup (0)              ;Leave room for BPB
boot_dataend    =       $

boot_disko      db      80h                     ;Disk to boot
boot_1:
                cli                             ;Disable interrupts
                cld                             ;Set direction UP.
                mov     ax,7a00h
                xor     bx,bx
                mov     ss,bx                   ;SS:SP = 0:7A00
                mov     sp,ax
                sti                             ;Interrupts OK
```

Figure 2: **This listing shows the the replacement boot record supplied by BOOT2C.**

BOOT2C Boot Record

2 of 2

```
                push    si                      ;Save Part table ptr
                push    bp                      ;Save BP
                mov     bp,ax                   ;Use BP for addressing

                mov     ds,bx                   ;DS = 0
                mov     es,bx                   ;ES = 0
                mov     di,ax                   ;Move boot code
                mov     si,7c00h                ;  to 0:7A00
                mov     cx,100h
                rep     movsw

                push    es                      ;Push re-entry segment
                mov     al,reloc_entry          ;  and offset on the
                push    ax                      ;  stack
                retf                            ;Return Far to jump
boot_2:
                mov     si,boot_initmsg         ;Announce we are here
                call    bprint_msg
                xor     ax,ax                   ;Read boot sector
                cwd
                mov     bx,7c00h                ;To address 0:7C00
                call    boot_read_disk
                jc      boot_error1
                cmp     boot_flag,0AA55h        ;Check for boot sig
                jne     boot_error
                mov     si,boot_chgmsg          ;Tell user about
                call    bprint_msg              ;  switch
                pop     bp                      ;Restore BP for
                pop     si                      ;  stupid DR-DOS bug
                jmp     bx                      ;Jump to new boot rec
boot_error:
                mov     si,boot_errmsg          ;Print err message
boot_error1:
                call    bprint_msg              ;Call print routine
boot_halt:
                jmp     boot_halt               ;STOP!

;---------------------------------------------------------------------
; Read disk - Reads one sector from the disk
; Entry: DX,AX - Absolute sector to read
;        BX - address of buffer.
; Exit:  CF - Clear if read successful.
;---------------------------------------------------------------------
boot_read_disk  proc    near
                push    bx
                div     sec_per_track           ;Get sectors per track
                inc     dx
read_2:
                mov     bx,dx                   ;Save sector
                cwd
                div     number_of_heads         ;Compute head and cylinder
                xchg    ah,al                   ;Swap cyl low and high bytes
                mov     cl,6
                shl     al,cl                   ;Shift high cyl bits
                xchg    cx,ax                   ;Copy cyl into CX
                or      cl,bl                   ;Combine cyl with sector
                mov     dh,dl                   ;Move head number
                mov     si,5                    ;Try to read 5 times.
                pop     bx
read_3:
                mov     dl,boot_disk            ;Get disk to read
                mov     ax,0201h                ;Read 1 sector
                int     13h                     ;Read/Write disk.
                jnc     read_exit               ;No error, exit
                xor     ax,ax                   ;Reset disk before reading
                int     13h
                dec     si
                jnz     read_3
                mov     si,boot_rerrmsg         ;Read error message
                stc
read_exit:
                ret
boot_read_disk  endp

;---------------------------------------------------------------------
; Print Msg - Prints a message to the screen
; Entry: DS:SI - Points to ASCII2 message
;---------------------------------------------------------------------
bprint_msg      proc    near
                push    bx
                push    bp
bprint_msg1:
                lodsb                           ;Get byte
                or      al,al                   ;If 0, end of string
                je      bprint_exit
                mov     ah,0eh                  ;BIOS print char
                mov     bx,7h
                push    si
                int     10h                     ;BIOS video services
                pop     si
                jmp     short bprint_msg1
bprint_exit:
                mov     ax,0e0dh                ;Append CR - LF
                int     10h
                mov     ax,0e0ah
                int     10h
                pop     bp
                pop     bx
                ret
bprint_msg      endp
program         db      'BOOT2C 1.0 Copyright 1993 Douglas Boling',13,10
                db      'First published in PC Magazine, March 30, 1993'
                db      13,10,0
change_msg      db      'Redirecting boot to '
change_dest     db 13 dup (0)
error_msg       db      'Error: Target disk not bootable'
                db      13,10,'System halted',0
readerr_msg     db      'Error: reading target drive'
                db      13,10,'System halted',0
bootcode_end    =       $
                org     2feh                    ;
This is offset by COM file base addr
                dw      0AA55h                  ;Boot signature
boot_end        =       $
```

forms a very similar litany, except extra code is added to query the user for the password. The tasks of the BOOTPW boot record are to ensure that the user enters the proper password, then to find and read the original boot record, write the original boot record back to its proper place, and finally to reboot the machine. Once the original boot record code has been rewritten to the boot sector, the reboot will cause the machine to continue the boot process as if BOOTPW had never existed. Of course, if there are no system files on the floppy disk, the reboot of the original boot record will display the "Non-System disk" message.

The protection provided to the disk is actually quite simple. The BOOTPW boot record does not conform to the DOS requirement for a BIOS Parameter Block located at the start of the disk. Thus, when DOS attempts to read the protected disk, it does not see a proper BPB and consequently reports a General Error back to the user. Until the correct boot sector is replaced, DOS is not able to access the disk.

BOOTPW can also unprotect a disk without requiring a machine reboot. To do this the BOOTPW program reads and writes the protected disk with DOS interrupt 25 (Absolute Sector Read) and DOS interrupt 26 (Absolute Sector Write). These functions can read the boot record of a protected disk even with a BOOTPW boot record installed.

Both BOOTPW and BOOT2C show what can be done with no more than the limited 512 bytes of a boot record. By modifying the boot record structure, BOOTPW confuses DOS so that the disk becomes inaccessible. On the other hand, BOOT2C's almost trivial code frees us from the frustration of that silly "Non-System or disk error" message. If you use a lot of floppy disks, you'll rejoice that the full use of your A: drive has been returned to you. □

DOUGLAS BOLING IS A CONTRIBUTING EDITOR TO *PC MAGAZINE*.

Claudia did not have the finances to finish college. Excess inventory donations to EAL gave her the scholarship she needed to graduate. Claudia is now with a leading financial trading firm, happily married with twin daughters.

Turn your **excess inventory** into a tax break and help send needy **kids to college**.

Call for your **free guide** to learn how donating your slow moving inventory can mean a generous **tax write off** for your company.

Call **708-690-0010**
PETER ROSKAM
Executive Director

EAL

P. O. Box 3021, Glen Ellyn, IL 60138 FAX (708) 690-0565

Excess inventory today...student opportunity tomorrow

VOL. 7
NO. 2

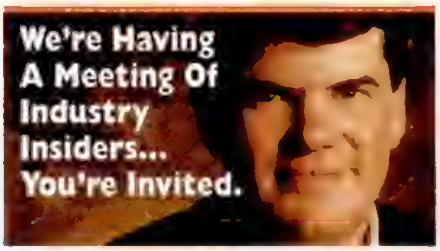
Ziff NET NEWS

Over 100,000 interested computer users rely on ZiffNet for virtually anything that has to do with computing. It's all here — thousands of the best downloadable shareware and freeware titles, including the world-famous *PC Magazine* utilities...late-breaking industry news...computer buying information...interactive industry forums...technical support ...and more — all available **online**!

This Month's Hot Software Downloads

TITLE	FILENAME	DESCRIPTION	LOCATION
Envision	ENVIS1.ZIP-ENVIS2.ZIP	The first true WYSIWYG desktop publishing program in shareware. GUI, mouse support, scalable fonts, object drawing, scaling and editing.	PBSAPPS LIB 8 Graphics
Neopaint	NEOPNT.ZIP	Paint and graphics program. Create and edit many different file types.	PBSAPPS LIB 8 Graphics
CornCob 3-D	CORNC1.ZIP-CORNC2.ZIP	Hi-res VGA flight simulator. Shoot down flying saucers and destroy alien ground bases.	PBSARC LIB 3 DOS Games
VIRX Virus Scanner	VIRX.ZIP	Catches over 1400 viruses, even in PKLITE and LZEXE compressed program files.	PBSAPPS LIB 3 DOS Utilities
AM-TAX 1992 Scanner	**AMTAX.ZIP**	**Just in time! Calculates and prints 1040 and schedules A, B, C, D, E, F, R and SE.**	PBSAPPS LIB 9 Business/Finance
Jill of the Jungle	JILL.ZIP	Great graphics and soundblaster effects on this exciting arcade game.	PBSARC LIB 3 DOS Games
Home Plan	HOMEPL.ZIP	Home design program. Design floor plans and furniture layouts.	PBSARC LIB 5 Home/Hobby
ZipKey	ZIPKEY.ZIP	Lookup program for ZIP codes, city names and states. Works a standalone or TSR.	PBSARC LIB 7 Data
WinZip	WINZIP.ZIP	Windows 3.1 utility to create, view and extract archive files and more.	PBSAPPS LIB 4 Windows Utilities
PC-Write	PCWA4A.ZIP PCWA4B.ZIP PCWA4C.ZIP PCWA4D.ZIP	Full-featured word processor with thesaurus, spell checker, indexing, table of contents, headers and footers, plus support for over 900 printers.	PBSAPPS LIB 6 DOS Applications

There are thousands more top-rated programs to choose from. Just type GO ZNT:SOFTLIB for a complete listing.



Here's your chance to tell the computing industry's movers and shakers what you really think about their products. As a ZiffNet member, you'll connect with product experts, Ziff editors and other knowledgeable users like yourself in our interactive forums. Drop by our Executives Online forum, for example, and discuss product issues and trends with industry leaders like **Philippe Kahn** — a frequent guest on ZiffNet. You'll also find in-depth information on just-released products, plus demos of the hottest new applications. To see what's in store, type GO ZNT:CALENDAR.

Get More Out Of Your Favorite Ziff Magazines... Online!

ZiffNet gives you direct access to the archives of Ziff magazine product reviews, buying guides, tips and tricks, and more. You'll also have in-depth information **linked to the current printed issues**, so you can dig deeper into topics of interest.

For example, when you see a new product reviewed in a First Look story, you can log on to ZiffNet and discuss it with the lab analysts, ask questions related to your own specific requirements — even download a demo of the product! You can also speak directly to Ziff editors and columnists like John Dvorak and Bill Machrone to get their opinions and insights. All you have to do is type GO ZNT:MAGAZINE. This kind of access to information and industry experts simply isn't available **anywhere else**.

READ IT, RESEARCH IT, DOWNLOAD IT, DISCOVER IT ONLINE, ON ZIFFNET.

NEW MEMBER SPECIAL

Computer Manuals Gather Dust As Online Technical Support Gathers Steam.

What do you do when you get the error message "SETUP ERROR #6020" while running the Windows™ 3.1 setup? Or discover that upgrading to DOS 5.0 has changed the fonts available in Windows Enhanced Mode? It could take hours to find the answer by poring over your manuals. But ZiffNet's one-of-a-kind Support On Site database gives you the answer **right away**. Here is the world's largest, most authoritative source of tech notes and other data on all major applications from leading hardware and software companies — Microsoft®, Borland®, WordPerfect®, IBM®, Hewlett Packard® and more — all organized in one convenient retrieval program. There's no easier way to get more out of the hardware and software you already own. Type GO ZNT:ONSITE.

Get The Inside Scoop On The Industry The Same Way Industry Leaders Do.

What will computer industry insiders be talking about next week? Find out on ZiffNet! You'll get weekly news summaries from *PC Week* and *MacWEEK* — controlled circulation publications — not available on any newsstand. But with ZiffNet, industry news, market trends, even inside information from Spencer Katt are all delivered right to your PC the Friday night **before** they're published. There's also *NewsBytes*, the award-winning international daily newswire to keep you right up to the minute on late-breaking developments.

Are You Really Making The Right Buying Decision?

Before you spend a dime on a system, printer, monitor or software, check out ZiffNet's Buying Advice. Here in one place you'll have access to the information you need to make a smart decision — objective information drawn from dozens of sources. ZiffNet guides you through the whole buying process — identifying the right products, evaluating them, and shopping for the best values. Search through reviews drawn from Ziff magazines...check out the product's ratings and awards...research compatibility issues...even query Ziff Buyers' Market for the latest direct-to-you prices. Best of all, you can ask Ziff experts, editors and other users for their opinions **before you buy**.

New Members To Receive Free Software Download!

Enroll online now, and receive a FREE download of "Windows Tips and Tricks," plus the complete ZiffNet Membership Kit, with maps of the service, the *Greatest Hits Software Collection* and your first issue of *Threads*, the ZiffNet newsletter. **See details below.**

LOG ON TO Ziff NET. AND GET A FREE SOFTWARE DOWNLOAD. HERE'S HOW:

Enroll in ZiffNet now and get a free download of "Windows Tips and Tricks", featuring nearly 100 valuable ideas and shortcuts for Windows 3.0 and 3.1 plus a free membership kit. Here's how to enroll:

COMPUSERVE® MEMBERS — type GO ZIFFNET

FROM ANY MODEM —

1. Set your communications software to 7 data bits, even parity, 1 stop bit. Select a data transfer rate (bits per second) of 1200, 2400 or 9600. Have your modem call the local ZiffNet number.*
2. Respond to the prompts with the information below:
   When you connect: <Ctrl C>
   Host Name: CIS
   User ID: 177000,5555
   PC User Password: ZIFF*NET
   Enter Agreement Number: ZAD4
   Register Name & Credit Card #
3. Now you'll receive your temporary User ID & Password. You will receive a permanent password by mail within 10 days.

* Find your local ZiffNet number:
By modem, dial 800-346-3247, at user ID prompt type PHONES.
By voice, dial 800-635-6225.

TO GET YOUR FREE COPY OF "WINDOWS TIPS AND TRICKS":
Type "GO GIFT" after enrollment.

NEW! Some of these services are now available on ZiffNet for PRODIGY. PRODIGY® members [JUMP℠]:**ziffnet** for full details.

ZiffNet membership fee is just $2.50 a month. Standard connect-time charges apply for certain services like downloading software: $12.80/hour at 1200 and 2400 baud; $22.80/hour at 9600 baud. Rates are fully explained online.

CIRCLE 070 ON READER SERVICE CARD

An Introduction to OS/2 Outline Fonts

BY CHARLES PETZOLD

By all accounts, one man and one company are responsible for first bringing scalable outline font technology within reach of the average user of personal computers. The man is John Warnock (who was presented with *PC Magazine*'s Lifetime Achievement award in 1989) and the company is Adobe Systems.

Adobe's PostScript is actually an entire programming language with a stack-oriented Forth-like structure. But the most important aspect of PostScript is its support of a hinted outline font technology. Most users first encountered Adobe's PostScript in high-end laser printers. Adobe ventured into the arena of video graphics with Display PostScript, but it's been largely ignored except for its implementation in NeXT machines.

Adobe was much more on the mark with Adobe Type Manager (ATM). ATM isn't a full-fledged graphics programming environment, but instead supports the display of fonts in the Adobe Type 1 format on video displays and printers from existing graphical environments. ATM was available first for the Macintosh and later for Windows 3.0 as retail products. ATM has also been licensed by IBM for inclusion in OS/2 2.0.

So, when we speak about the support of outline fonts by the GPI (Graphics Programming Interface) of the OS/2 2.0 Presentation Manager, we're really speaking about the support of Adobe Type 1 fonts. OS/2 2.0 is shipped with 13 Type 1 fonts, and you can install additional Type 1 fonts for use with PM programs.

FACE NAMES VERSUS ATTRIBUTES The early support of fonts in graphical environments such as the Macintosh, Windows, and the OS/2 Presentation Manager was not based very much on classical typography. You began with a face name such as Helvetica or Helv and then for certain words or sections in your document, you'd apply an attribute such as boldface or italic. This is how the bitmapped fonts in PM work.

The Type 1 outline fonts supported by PostScript and ATM are more closely bound to classical typography. Rather than treating boldface and italic as attributes, these characteristics are part of the typeface name, such as Helvetica Bold, Helvetica Italic, and Helvetica Bold Italic.

Outline fonts are more closely bound to classical typography than fonts in early graphical environments, leading—as we'll see—to oddities in their implementation.

This may seem like a trivial difference, but it's not, really, for it determines how users select fonts for their documents. Some slanted fonts may include the word *oblique* in their typeface names rather than the word *italic*. Some fonts may have different degrees of boldness, using words such as *heavy, light, and dark*. It's more complex than a simple matter of clicking a check box to turn on a boldface flag.

In the January 12, 1993, installment of this column, I discussed the fields of the FONTMETRICS structure (which describes a font under OS/2), including the fsSelection field. This field is supposed to be made up of bit flags that indicate whether the font is boldface or italic. However, the only bit that is possibly set when querying available fonts is the FM_SEL_ITALIC bit, and that's only if the typeface name contains the word *italic* (but not *oblique*).

So, unless you want to parse typeface names, you're stuck with presenting the full typeface names to the user. This is an area where I think Microsoft has come up with a better idea. In the implementation of TrueType in Windows 3.1, Windows gives each font three names: the family name (for example, Arial—the TrueType version of Helvetica); the typeface name (for example, Arial Bold Italic); and a style name (for example, Bold Italic). If the family name is the same as the typeface name, then the style name is Regular.

In Windows, this makes it fairly easy to categorize fonts by family and then to indicate which styles are available for each particular family. Thus, the user can pick a family name (such as Arial) from a list box, and then another list box could list the various styles (Italic, Bold, and Bold Italic) available for that particular font family.

The conflict between full typeface names and attributes gets a little weirder in OS/2 because of the fact that the italic and boldface attributes—normally used to simulate these effects on bitmapped fonts—are still valid for outline fonts. You can indeed apply a boldface attribute to a Helvetica font. However, it will be a simulated boldface and won't look the same as the real Helvetica Bold font. You can also apply the boldface attribute to the Helvetica Bold font to get an even bolder font. The same principle holds true for the italic attribute.

OUTFONTS.MAK

Complete Listing

```
#------------------------
# OUTFONTS.MAK make file
#------------------------

outfonts.exe : outfonts.obj outfonts.def outfonts.res
     link386 /BASE:0x10000 outfonts,, NUL,, outfonts
     rc outfonts.res

outfonts.obj : outfonts.c outfonts.h
     icc -C -Kbcpr -Ss outfonts.c

outfonts.res : outfonts.rc outfonts.h
     rc -r outfonts.rc
```

Figure 1: **The make file to use with the IBM C Compiler to create OUTFONTS.EXE.**

THE OUTFONTS PROGRAM If you're curious to see these oddities illustrated on the screen, you can download the executable for the OUTFONTS program, shown in Figures 1 through 5, from PC MagNet (archived as OUTFON.ZIP)and run the program under the OS/2 Presentation Manager. Alternatively, if you have the IBM C Developer's WorkSet/2 installed, you can download the source code from PC MagNet and create OUTFONTS.EXE by running

```
NMAKE OUTFONTS.MAK
```

on an OS/2 2.0 command line.

The OUTFONTS program is very similar to the BITFONTS program, which I discussed in the January 26, 1993, installment of this column. The GetAllOutlineFonts function in OUTFONTS uses GpiQueryFonts to determine the number of fonts on the video display, and then calls GpiQueryFonts again to obtain descriptions of the fonts as an array of FONTMETRICS structures. The function then loops through all the fonts and copies those with the FM_DEFN_OUTLINE flag set in the fsDefn field of the FONTMETRICS structure to another array of FONTMETRICS structures—these are the outline fonts. The function reallocates the memory for this second array and returns the array and the number of outline fonts. During the WM_PAINT message, OUTFONTS displays all the outline fonts. (I'll discuss the font selection code shortly.) Each font is displayed with a text string consisting of a space, followed by a 0xDB character (a solid block), followed by another space, the typeface name and point size, followed by another space, another 0xDB character, and a final space.

As you'll recall, bitmapped fonts come in various typeface names with various point sizes for each. The BITFONTS program listed all the bitmapped fonts on the system—System Proportional and System Monospaced at 10 points; Courier at 8, 10, and 12 points; and Tms Rmn and Helv at 8, 10, 12, 14, 18, and 24 points. The Attributes menu in BITFONTS is then used to select boldface, italic, underscore, and strikeout attributes. To refresh your memory, the default BITFONTS window is shown in Figure 6.

Because outline fonts are scalable, they come in only one size. Instead of variations by size, many outline fonts come in bold, italic, and bold italic versions. I've added a Point-Size menu to OUTFONTS that lets you select a size (4, 8, 10, 12, 14, 18, 24, 36, and 48 points).

OUTFONTS.C

1 of 3

```
/*-----------------------------------------
   OUTFONTS.C -- Displays OS/2 Outline Fonts
                 (c) Charles Petzold, 1993
  -----------------------------------------*/

#define INCL_WIN
#define INCL_GPI
#include <os2.h>
#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include "outfonts.h"

#define LCID_FONT    1

MRESULT EXPENTRY ClientWndProc (HWND, ULONG, MPARAM, MPARAM) ;

int main (void)
     {
     static CHAR  szClientClass [] = "OutFonts" ;
     static ULONG flFrameFlags = FCF_TITLEBAR      | FCF_SYSMENU  |
                                 FCF_SIZEBORDER    | FCF_MINMAX   |
                                 FCF_SHELLPOSITION | FCF_TASKLIST |
                                 FCF_MENU ;
     HAB          hab ;
     HMQ          hmq ;
     HWND         hwndFrame, hwndClient ;
     QMSG         qmsg ;

     hab = WinInitialize (0) ;
     hmq = WinCreateMsgQueue (hab, 0) ;

     WinRegisterClass (hab, szClientClass, ClientWndProc, CS_SIZEREDRAW, 0) ;

     hwndFrame = WinCreateStdWindow (HWND_DESKTOP, WS_VISIBLE,
                                     &flFrameFlags, szClientClass,
                                     "Outline Fonts", 0L,
                                     NULLHANDLE, ID_RESOURCE, &hwndClient) ;

     while (WinGetMsg (hab, &qmsg, NULLHANDLE, 0, 0))
          WinDispatchMsg (hab, &qmsg) ;

     WinDestroyWindow (hwndFrame) ;
     WinDestroyMsgQueue (hmq) ;
     WinTerminate (hab) ;
     return 0 ;
     }

LONG GetAllOutlineFonts (HPS hps, PFONTMETRICS * ppfm)
     {
     LONG          l, lAllFnt, lOutFnt ;
     PFONTMETRICS pfmAll, pfmOut ;

               // Find number of fonts

     lAllFnt = 0 ;
     lAllFnt = GpiQueryFonts (hps, QF_PUBLIC, NULL, &lAllFnt, 0, NULL) ;

     if (lAllFnt == 0)
          return 0 ;

               // Allocate memory for FONTMETRICS structures

     pfmAll = (PFONTMETRICS) calloc (lAllFnt, sizeof (FONTMETRICS)) ;

     if (pfmAll == NULL)
          return 0 ;

     pfmOut = (PFONTMETRICS) calloc (lAllFnt, sizeof (FONTMETRICS)) ;

     if (pfmOut == NULL)
          {
          free (pfmAll) ;
          return 0 ;
```

Figure 2: **OUTFONTS.C contains the source code for the program.**

OUTFONTS.C

2 of 3

```
     }
          // Get all fonts

GpiQueryFonts (hps, QF_PUBLIC, NULL, &lAllFnt,
               sizeof (FONTMETRICS), pfmAll) ;

          // Get all the outline fonts

lOutFnt = 0 ;

for (l = 0 ; l < lAllFnt ; l++)
     if (pfmAll[l].fsDefn & FM_DEFN_OUTLINE)
          pfmOut [lOutFnt ++] = pfmAll [l] ;

          // Clean up

free (pfmAll) ;
pfmOut = (PFONTMETRICS) realloc (pfmOut, lOutFnt * sizeof (FONTMETRICS)) ;

* ppfm = pfmOut ;

return lOutFnt ;
}

MRESULT EXPENTRY ClientWndProc (HWND hwnd, ULONG msg, MPARAM mp1, MPARAM mp2)
     {
     static BOOL         fItalic, fUnder, fOutline, fStrike, fBold,
                         fBaseline, fTextBox ;
     static FATTRS       fat ;
     static HWND         hwndMenu ;
     static int          aiPtSizes []
= { 4, 8, 10, 12, 14, 18, 24, 36, 48 } ;
     static LONG         xRes, yRes, lFonts ;
     static PFONTMETRICS pfm ;
     static SHORT        cyClient, sPtSize = IDM_PTS12 ;
     CHAR                szBuffer [FACESIZE + 32] ;
     FONTMETRICS         fm ;
     HDC                 hdc ;
     HPS                 hps ;
     int                 i, iPtSize ;
     LONG                l ;
     POINTL              ptl, aptl [TXTBOX_COUNT] ;
     SIZEF               sizef ;

     switch (msg)
          {
          case WM_CREATE:
                         // Get the array of FONTMETRICS structures

               hps = WinGetPS (hwnd) ;
               GpiQueryFontAction (hps, QFA_PUBLIC) ;
               lFonts = GetAllOutlineFonts (hps, & pfm) ;

                         // Get the font resolution of the device

               hdc = GpiQueryDevice (hps) ;
               DevQueryCaps (hdc, CAPS_HORIZONTAL_FONT_RES, 1, &xRes) ;
               DevQueryCaps (hdc, CAPS_VERTICAL_FONT_RES,   1, &yRes) ;
               WinReleasePS (hps) ;

                         // Get menu window handle

               hwndMenu = WinWindowFromID (WinQueryWindow (hwnd, QW_PARENT),
                                           FID_MENU) ;
               return 0 ;

          case WM_SIZE:
               cyClient = HIUSHORT (mp2) ;
               return 0 ;

          case WM_COMMAND:
               switch (COMMANDMSG(&msg)->cmd)
                    {
                    case IDM_PTS04:
                    case IDM_PTS08:
                    case IDM_PTS10:
                    case IDM_PTS12:
                    case IDM_PTS14:
                    case IDM_PTS18:
                    case IDM_PTS24:
                    case IDM_PTS36:
                    case IDM_PTS48:
                         WinCheckMenuItem (hwndMenu, sPtSize, FALSE) ;
                         sPtSize = COMMANDMSG(&msg)->cmd ;
                         break ;

                    case IDM_ITALIC:      fItalic   = ! fItalic   ;  break ;
                    case IDM_UNDERSCORE:  fUnder    = ! fUnder    ;  break ;
                    case IDM_OUTLINE:     fOutline  = ! fOutline  ;  break ;
                    case IDM_STRIKEOUT:   fStrike   = ! fStrike   ;  break ;
                    case IDM_BOLD:        fBold     = ! fBold     ;  break ;
                    case IDM_BASELINE:    fBaseline = ! fBaseline ;  break ;
                    case IDM_TEXTBOX:     fTextBox  = ! fTextBox  ;  break ;

                    default:  return 0 ;
                    }

               WinCheckMenuItem (hwndMenu, COMMANDMSG(&msg)->cmd,
                  ! WinIsMenuItemChecked (hwndMenu, COMMANDMSG(&msg)->cmd)) ;

               WinInvalidateRect (hwnd, NULL, TRUE) ;
               return 0 ;

          case WM_PAINT:
               hps = WinBeginPaint (hwnd, NULLHANDLE, NULL) ;

               GpiErase (hps) ;

                    // Get new fonts if they've changed

              if (QFA_PUBLIC & GpiQueryFontAction (hps, QFA_PUBLIC))
                   {
                   free (pfm) ;
                    lFonts = GetAllOutlineFonts (hps, & pfm) ;
                   }

                   // Set POINTL structure to upper left corner of client

               ptl.x = 0 ;
               ptl.y = cyClient ;

                    // Set the character box for the point size

              iPtSize = aiPtSizes [sPtSize - IDM_PTS04] ;

              sizef.cx = 65536 * xRes * iPtSize / 72 ;
              sizef.cy = 65536 * yRes * iPtSize / 72 ;

              GpiSetCharBox (hps, &sizef) ;

                    // Loop through all the bitmap fonts

              for (l = 0 ; l < lFonts ; l++)
                   {
                        // Define the FATTRS structure

                   fat.usRecordLength  = sizeof (FATTRS) ;

                   fat.fsSelection = (fItalic  ? FATTR_SEL_ITALIC     : 0) |
                                     (fUnder   ? FATTR_SEL_UNDERSCORE : 0) |
                                     (fOutline ? FATTR_SEL_OUTLINE    : 0) |
                                     (fStrike  ? FATTR_SEL_STRIKEOUT  : 0) |
                                     (fBold    ? FATTR_SEL_BOLD       : 0) ;

                   fat.lMatch          = 0 ;

                   strcpy (fat.szFacename, pfm[l].szFacename) ;

                   fat.idRegistry      = pfm[l].idRegistry ;
                   fat.usCodePage      = pfm[l].usCodePage ;
                   fat.lMaxBaselineExt = 0 ;
                   fat.lAveCharWidth   = 0 ;
                   fat.fsType          = FATTR_FONTUSE_OUTLINE |
                                         FATTR_FONTUSE_TRANSFORMABLE ;
                   fat.fsFontUse       = 0 ;

                        // Create the logical font and select it

                   GpiCreateLogFont (hps, NULL, LCID_FONT, &fat) ;
                   GpiSetCharSet (hps, LCID_FONT) ;

                        // Query the font metrics of the current font

                   GpiQueryFontMetrics (hps, sizeof (FONTMETRICS), &fm) ;

                        // Set up a text string to display

                   sprintf (szBuffer, " \xDB %s - %d points \xDB ",
                            fm.szFacename, iPtSize) ;

                        // Drop POINTL structure to baseline of font

                   ptl.y -= fm.lMaxAscender ;

                        // Display the character string

                  GpiCharStringAt (hps, &ptl, strlen (szBuffer), szBuffer) ;

                        // Adjust text box points for left baseline

                   GpiQueryTextBox (hps, strlen (szBuffer), szBuffer,
                                    TXTBOX_COUNT, aptl) ;

                   for (i = 0 ; i < TXTBOX_COUNT ; i++)
                        {
                        aptl[i].x += ptl.x ;
                        aptl[i].y += ptl.y ;
                        }

                        // Possibly display the baseline

                   if (fBaseline)
                        {
                        GpiMove (hps, &ptl) ;
```

OUTFONTS.C
3 of 3

```
        GpiLine (hps, aptl + TXTBOX_CONCAT) ;
        }

        // Possibly display the character box

    if (fTextBox)
        {
        GpiMove (hps, aptl + TXTBOX_TOPLEFT) ;
        GpiLine (hps, aptl + TXTBOX_TOPRIGHT) ;
        GpiLine (hps, aptl + TXTBOX_BOTTOMRIGHT) ;
        GpiLine (hps, aptl + TXTBOX_BOTTOMLEFT) ;
        GpiLine (hps, aptl + TXTBOX_TOPLEFT) ;
        }

        // Drop POINTL structure down to bottom of text

    ptl.y -= fm.lMaxDescender ;
```

```
                    // Select the default font; delete the logical font

                GpiSetCharSet (hps, LCID_DEFAULT) ;
                GpiDeleteSetId (hps, LCID_FONT) ;
                }

            WinEndPaint (hps) ;
            return 0 ;

        case WM_DESTROY:
            if (lFonts > 0)
                free (pfm) ;

            return 0 ;
        }
    return WinDefWindowProc (hwnd, msg, mp1, mp2) ;
    }
```

In actual practice, the size of an outline font can be scaled to almost anything within reason, even fractional point sizes. The default OUTFONTS display is shown in Figure 7.

The first 21 lines in the display show the standard 13 Adobe fonts. The Helvetica and Helv fonts are exactly the same: GPI has simply retained the Helv name used in OS/2, Version 1.1, for the old unhinted outline fonts, but uses the Adobe Helvetica font instead. The same is true for the Times New Roman and the Tms Rmn fonts. The other fonts at the bottom of the display are some of those I've installed from other Adobe type packages.

CREATING AND SELECTING THE FONT

Creating and selecting a logical outline font is much the same as creating and selecting a logical bitmapped font. You first set up the fields of a FATTRS structure and then pass it to the GpiCreateLogFont function. At this point the logical font is associated with a local ID (often called an "lcid" and pronounced "el cid," but not to be confused with the Charlton Heston movie). You then use the GpiSetCharSet function in order to select that font—referenced by the local ID—into your presentation space.

However, there are a couple of differences between selecting bitmapped and outline fonts, as demonstrated in the WM_PAINT processing in OUTFONTS.C. For outline fonts, you set the lMaxBaselineExt and lAveCharWidth fields of the FATTRS structure to 0. The size of the font is not specified here. Also, you set the fsType field to the combination of the FATTR_FONTUSE_OUTLINE and the FATTR_FONTUSE_TRANSFORMABLE flags. The first flag insures that you get an outline font. The second flag is used to indicate that you want a font that is subject to graphics transforms. This is true of all outline fonts anyway, but I tend to include the second flag regardless of that.

You set the point size of the font using the GpiSetCharBox function:

```
GpiSetCharBox (hps,&sizef) ;
```

where the second parameter is a pointer to a SIZEF structure. The structure has two fields (cx and cy) that are treated as 32-bit fixed-point values. The high 16-bit part is an integer value, and the lower 16 bits represent a fraction of 65,536. The cy field indicates the em-height of the font (which is equivalent to the point size) and the cx field indicates the em-width—the point size in horizontal coordinates.

OUTFONTS.RC
Complete Listing

```
/*---------------------------------
   OUTFONTS.RC resource script file
  ---------------------------------*/

#include <os2.h>
#include "outfonts.h"

MENU ID_RESOURCE
     {
     SUBMENU "~Point-Size",                IDM_SIZE
          {
          MENUITEM "~1.  4 points",        IDM_PTS04
          MENUITEM "~2.  8 points",        IDM_PTS08
          MENUITEM "~3.  10 points",       IDM_PTS10
          MENUITEM "~4.  12 points",       IDM_PTS12,, MIA_CHECKED
          MENUITEM "~5.  14 points",       IDM_PTS14
          MENUITEM "~6.  18 points",       IDM_PTS18
          MENUITEM "~7.  24 points",       IDM_PTS24
          MENUITEM "~8.  36 points",       IDM_PTS36
          MENUITEM "~9.  48 points",       IDM_PTS48
          }
     SUBMENU "~Attributes",                IDM_ATTRS
          {
          MENUITEM "~Italic",              IDM_ITALIC
          MENUITEM "~Underscore",          IDM_UNDERSCORE
          MENUITEM "~Outline",             IDM_OUTLINE
          MENUITEM "~Strikeout",           IDM_STRIKEOUT
          MENUITEM "~Bold",                IDM_BOLD
          }
     SUBMENU "~Show",                      IDM_SHOW
          {
          MENUITEM "~Baseline",            IDM_BASELINE
          MENUITEM "~Text Box",            IDM_TEXTBOX
          }
     }
```

Figure 3: **This resource script defines OUTFONTS.EXE's menu.**

Normally, the cx and cy fields are set to the same value, which is the point size in logical units. (By default, logical units are the same as device units, which are pixels.) There are two exceptions: If your logical units are unequal in the horizontal and vertical directions—which is the case for the pixel resolution of the EGA—then you can compensate for that by using unequal values of cx and cy. You can also use unequal values if you want the font to appear wider or narrower than normal.

It is customary to call the GpiSetCharBox function after the font has been selected in the presentation space. However, because the character box attribute applies to the presentation space, you can call it at any time while the presentation space handle is valid. Unless later set to a different value, it will apply to all fonts subsequently selected in the presentation space. To speed along the display of the fonts, I've chosen to call GpiSetCharBox once before looping through the font displays.

The tricky part here is converting a point size to pixels. During the WM_CREATE message, I call DevQueryCaps to obtain the horizontal and vertical font resolution of the video display. As you'll recall, the font resolution is an "ideal" video display resolution. For the VGA, the font resolution is given as 96 pixels per inch, whereas the real resolution of the VGA is more like 68 pixels per inch. The use of the font resolution to size outline fonts results in larger character sizes, which are more readable on the screen.

When OUTFONTS calculates the cx and cy fields of the SIZEF structure, it multiplies the point size by the font resolution (in pixels per inch) and divides by 72—the number of points in an inch. This yields the size of the font in pixels. This pixel size is multiplied by 65,536 to convert to a fixed point value. For a 12-point font on the VGA, for example, the pixel em-height and em-width are 16.

FINDING THE FONT HEIGHT As you'll recall, there are a couple of ways to determine the height of the current font selected in the presentation space. You can call the GpiQueryFontMetrics function and use the lMaxAscender and lMaxDescender fields of the FONTMETRICS structure to determine the maximum height of the font characters above and below the baseline. You can also use the GpiQueryTextBox function to determine this same information.

For bitmapped fonts, the lMaxAscender and lMaxDescender fields of the FONTMETRICS structure are consistent with the information obtained from the GpiQueryTextBox function; for outline fonts, there is often a slight difference. I suspect that this is a rounding problem somewhere with GPI.

This inconsistency becomes most noticeable when you use the Show menu option to display the text boxes of each displayed line of text. The program uses the FONTMETRICS lMaxAscender and lMaxDescender fields to space the lines of text, and—as you can see in the top screenshot in Figure 8—the tops and bottoms of each successive text box do not always align correctly. Another difference you'll notice is that the text box of

OUTFONTS.DEF

Complete Listing

```
;------------------------------------
; OUTFONTS.DEF module definition file
;------------------------------------

NAME            OUTFONTS  WINDOWAPI

DESCRIPTION     'Outline Fonts in OS/2 2.0 PM (c) Charles Petzold, 1993'
PROTMODE
```

Figure 5: **OUTFONTS.DEF is the program's module definition file.**

OUTFONTS.H

Complete Listing

```
/*------------------------
   OUTFONTS.H header file
  ------------------------*/

#define ID_RESOURCE         1

#define IDM_SIZE            10
#define IDM_PTS04           11
#define IDM_PTS08           12
#define IDM_PTS10           13
#define IDM_PTS12           14
#define IDM_PTS14           15
#define IDM_PTS18           16
#define IDM_PTS24           17
#define IDM_PTS36           18
#define IDM_PTS48           19

#define IDM_ATTRS           20
#define IDM_ITALIC          21
#define IDM_UNDERSCORE      22
#define IDM_OUTLINE         23
#define IDM_STRIKEOUT       24
#define IDM_BOLD            25

#define IDM_SHOW            30
#define IDM_BASELINE        31
#define IDM_TEXTBOX         32
```

Figure 4: **The header file defines constants used in the C source code and resource script.**

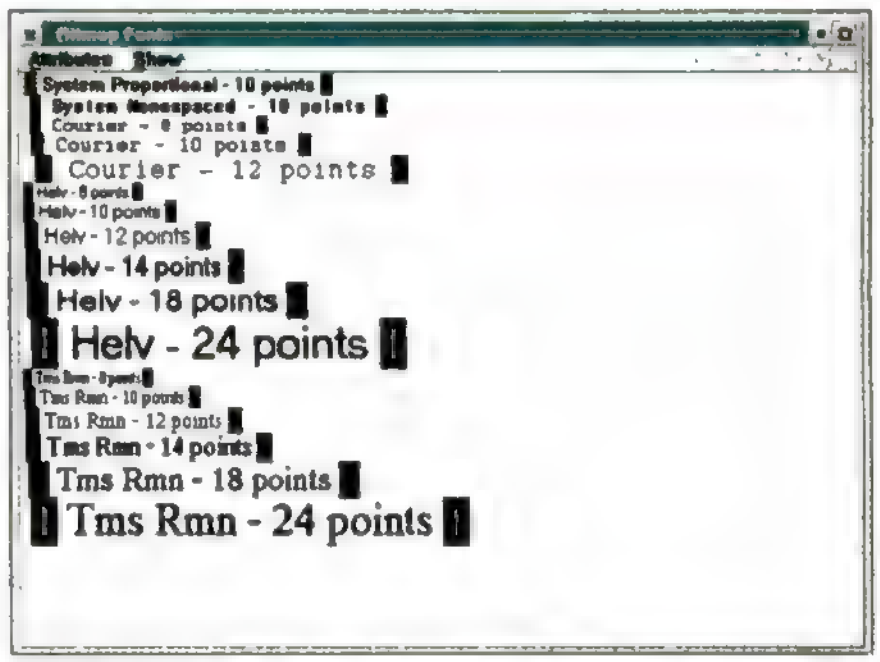


Figure 6: **The output of the BITFONTS program from the January 26, 1993, issue of *PC Magazine*.**

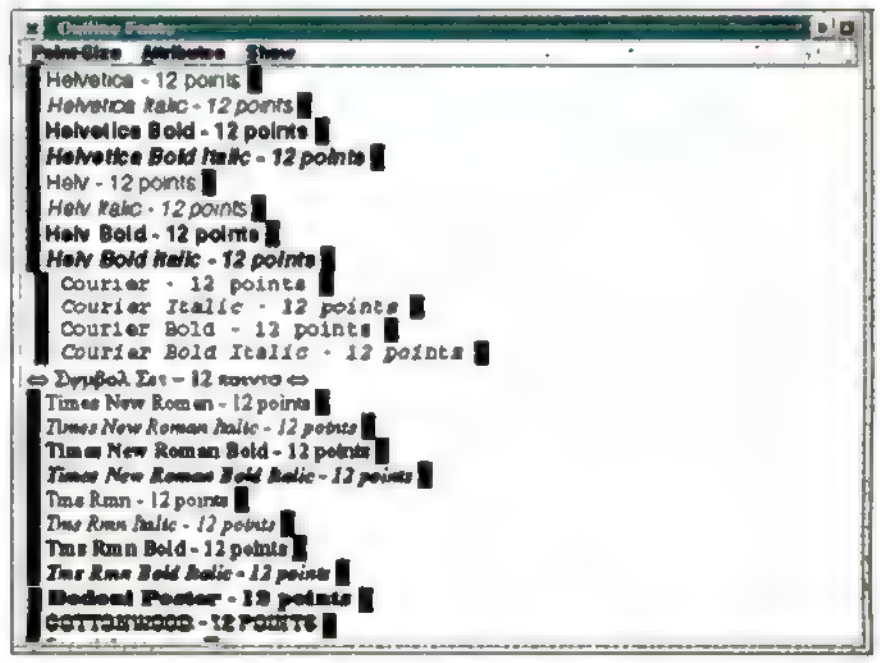


Figure 7: **This screenshot shows the default display of the OUTFONTS program.**

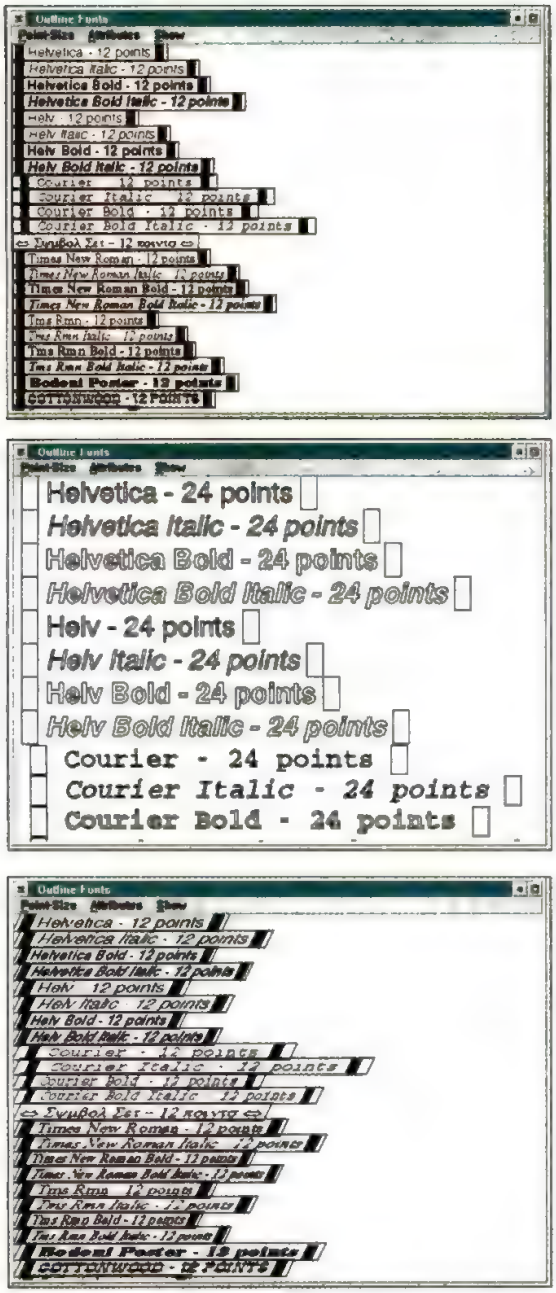


Figure 8: **The OUTFONTS display with: (top) the character box shown; (middle) the outline attribute selected; and (bottom) the italic and boldface attributes selected.**

the italic fonts does not reflect the slant of the characters as it does with bitmapped fonts.

THE ATTRIBUTES MENU As with BITFONTS, I've included an Attributes menu that lets you select italic, boldface, outline, underscore, and strikeout attributes. These are used to set up flags in the fsSelection field of the FATTRS structure before calling GpiCreateLogFont.

The outline attribute does not work with bitmapped fonts, but it works with outline fonts and results in the font appearing as outlined characters rather than filled characters, as shown in the middle screenshot in Figure 8. I've used a larger font size in the figure in order to make the outlines more obvious.

You can also select the italic and boldface attributes, but these are simulations applied to the font. As I mentioned earlier in the column, a Times New Roman Italic font is not the same as a Times New Roman font with the italic attribute, and a Times New Roman Bold font is not the same as a Times New Roman font with the boldface attribute. This should be obvious in the last screenshot in Figure 8, which shows the fonts with both the italic and boldface attributes applied. Look at the difference in the lowercase *a* of the simulated italic version of the Times New Roman font and the real Times New Roman Italic font. Also notice that the text box now shows that the characters are slanted.

DOCUMENTATION FOLLY In the past columns on fonts in OS/2, I've discussed some areas where IBM's technical reference documentation is wrong and where it describes something that simply has not yet been implemented. One of the biggest blunders I've found has to do with the discussion of FATTR_SEL_OUTLINE. The OS/2 documentation specifically makes a point of recommending the use of this option for small font sizes.

The printed documentation (in Volume 1 of the *Presentation Manager Programming Reference* of the *OS/2 2.0 Technical Library*) for GpiCreateLogFont says, "Outline font characters are normally drawn filled. However, hollow characters are produced if the FATTR_SEL_OUTLINE flag is set in the pAttrs parameter. For small characters, outlining in this way can give a similar visual appearance to filled characters, with improved performance." The documentation of the FATTRS structure repeats this advice: "Setting this flag normally gives better performance, and for sufficiently small characters there may be little visual difference."

It sounds reasonable in theory, but it just isn't true. Don't take my word for it—try it out yourself with the OUTFONTS program. Not only is performance much worse with the FATTR_SEL_OUTLINE flag set, but the characters are more ragged as well. My advice: Don't use the FATTR_SEL_OUTLINE flag unless you really want outlined characters.

The outline attribute doesn't work with bitmapped fonts, but it works with outline fonts and results in the fonts appearing as outlined characters rather than filled characters.

How did such an error ever get into the OS/2 documentation? Didn't anybody ever try it out? Well, I suspect it originated in the pre-ATM days. The rasterized versions of the original outline fonts in OS/2 1.1 were not cached in memory. Instead, GPI had to algorithmically calculate a filled area for each character as it was being drawn. This takes more time than simply drawing an outline. However, because ATM caches rasterized versions of the characters in memory, displaying the character bitmaps on the screen is much faster than displaying the outlines.

SIMPLIFIED FONT SELECTION In the next issue, I'll do something similar to what I did with the bitmapped fonts: I'll encapsulate outline font selection in some easy-to-use functions that you will be able to implement in your own PM programs. □

SOME SUPPORT PEOPLE HAVE ALL THE ANSWERS.

SUPPORTS WINDOWS 3.1

THE LATEST TECHNICAL SUPPORT. Support on Site™ for Applications is the most comprehensive and complete source of technical support information anywhere. It covers all the leading PC software applications and operating environments. It's on a single CD-ROM. And it's updated every month.

FAST ANSWERS. Support on Site helps solve software problems quickly. Its key uses are: • Handling conflicts between products • Identifying the solutions to error messages • Configuring software • Obtaining the latest drivers and ancillary software • Providing information on advanced techniques.

ANSWERS ON THE DESKTOP. Support on Site works right at the support desk. It combines extensive technical and operational software information in one quick, search-and-retrieve program. When a word or phrase is typed the entire database is quickly searched. And there's an answer in seconds.

ANSWERS FROM THE PUBLISHERS. The information on Support on Site comes directly from software publishers. It's their manuals and technical notes – and much of it has never been available before. Plus there's information from Cobb Newsletters and reference books by Que and Ziff-Davis Press. Support on Site even includes proprietary software – drivers, patches, bug fixes and macros – again directly from software publishers.

SUPPORTS ALL THIS SOFTWARE. Support on Site supports all these applications and operating systems – and more are being added every month!

ALDUS CORPORATION
Aldus® PageMaker® for Windows™

BORLAND INT'L, INC.
dBase®
MultiMate®
Paradox®
Quattro® Pro

CENTRAL POINT SOFTWARE
PC Tools®

COMPUTER ASSO., INT'L
Compete!
Cricket Presents
dbFast
SuperCalc

FOX SOFTWARE, INC.
FoxPro™

IBM CORPORATION
OS/2®

LOTUS DEVELOPMENT CORP.
Freelance Graphics™ for DOS™
Freelance Graphics™ for Windows™
Lotus® 1-2-3®
Lotus® 1-2-3® for Macintosh
Lotus® 1-2-3® for Windows™
Lotus® Magellan
Lotus® Symphony®
Ami Pro™

MICROSOFT CORP.
Microsoft® Excel®
Excel® for Macintosh
Microsoft® Windows™
Microsoft® Word® for DOS
Microsoft® Word® for Windows™
Word® for Macintosh
Microsoft® Works®
Microsoft® Works® for Windows™
MS-DOS
PowerPoint®
Microsoft® Project

QUARTERDECK OFFICE SYSTEMS
QEMM™
DESQView™

SOFTWARE PUB. CORP.
Harvard Graphics™

SYMANTEC
Q&A™

SYMANTEC/PETER NORTON COMPUTING GROUP
Norton AntiVirus for DOS
Norton AntiVirus for Windows™
Norton Backup
Norton Backup for Windows™
Norton Desktop for Windows™
Norton Utilities for the Macintosh
pcAnywhere

WORDPERFECT CORP.
WordPerfect® for Windows™
WordPerfect®

WORDSTAR INTERNATIONAL, INC.
WordStar®

GET ALL THE ANSWERS FOR YOURSELF. Call today. See how Support on Site can boost support productivity, expand capabilities, control costs and answer support questions – fast.

1-800-827-7889 EXT. 332

COMPUTER LIBRARY

CIRCLE 033 ON READER SERVICE CARD

FAST ANSWERS TO SOFTWARE QUESTIONS

and Support on Site are trademarks of their respective companies

Export Tables in Windows NT Executable Files

BY RAY DUNCAN

In the first column on the Windows NT PE (portable executable) file format (*PC Magazine*, February 9, 1993), I discussed how PE files are related to the Unix Common Object File Format (COFF), explained the file's overall structure, and provided some example code that listed a file's sections and characteristics and dumped out its import table. In the most recent column (*PC Magazine*, March 16, 1993), I continued the discussion by dissecting and analyzing the structure of a PE file's resource table, including source code to create a simple list of resources and code to format a resource directory tree. In this installment, we'll take a look at yet another important component of PE files.

But first, a word of caution. The PE file-related code that has been published in these columns has been developed and tested on the October 1992 beta release of Windows NT. By the time you read this, at least one additional beta release of NT will have been shipped, and it is quite possible that the PE format will have been altered or extended in some way. Consequently, you should consider the code you find published here only as a general framework for working with PE files, and you should not assume that it is necessarily accurate for the version of NT that you are currently running. The programs which appear in this column are available for downloading from the Programming Forum of PC MagNet, and they will be updated and revised on a regular basis to keep them in sync with Windows NT until the system becomes stable.

EXPORT TABLES AND DYNAMIC LINKING Windows NT, like Windows 3.*x* and OS/2, depends heavily on dynamic linking—that is, "late binding" of an application at its load-time or runtime to shareable code and data in special files called dynamic link libraries (DLLs). Functions that are dynamically linked can be designated symbolically (that is, by name) or, for increased linking speed, by an integer identifier called an *ordinal*. Load-time dynamic linking occurs at the time a new program is brought into memory but before it starts executing, and thus is completely under the control of the system loader; runtime dynamic linking is performed by way of application calls to Windows NT APIs and hence is more flexible (but also more work for the programmer). For the purposes of this installment, we'll limit our discussion to load-time dynamic linking.

A DLL detective story: finding how DLLs keep track of exported functions and using a Windows NT program to report this information.

In general terms, in order for load-time dynamic linking to occur, we know from our Windows 3.*x* and OS/2 experience that the system loader needs two pieces of information:

- From the application, it needs a structure called an *import table*, which lists the names of DLLs and the functions to be bound within those DLLs.
- From each DLL, it needs a structure called an *export table*, which lists all the functions made available for dynamic linking by that DLL and the addresses of their entry points.

Given this information, dynamic linking is a relatively straightforward recursive process of traversing the application's import table, loading the specified dynamic link libraries, looking up the functions in the DLLs' export tables, patching the CALL instructions in the application's executable image to point to the DLL entry points, loading any DLLs that are referenced by the already loaded DLLs, and so on, until all dynamic links are resolved. If a DLL can't be found or there is a mismatch between an import and export table, the system will refuse to run the application and will display an error message.

How does a DLL's export table get created? Every function in the DLL that is going to be called from outside the DLL—whether by an application or by Windows NT itself—must be declared with the proper keyword (APIENTRY, WNDPROC, CALLBACK, and so on). Then, when the DLL is linked from its component object modules, one of the files that is fed to the linker is a so-called *module definition file* (.DEF file). The .DEF file contains a LIBRARY statement indicating that a DLL is to be created instead of a normal executable file, and an EXPORTS command that specifies which of the DLL's functions are to be made visible for dynamic linking by applications in the export table. (The .DEF file may also contain several other commands, which we will ignore for the time being.) Interestingly, under Windows 3.*x* and OS/2, a .DEF file is needed for linking of any type of executable file, but in Windows NT it is required only for DLLs.

UNRAVELING THE PE EXPORT TABLE It would be nifty to extend the EXELOOK utility that we've been developing over

The Export Table of WSOCK32.DLL

Complete Listing

```
C>COFF -DUMP -EXPORTS WSOCK32.DLL

Dump of file wsock32.dll

          Section contains the following Exports for WSOCK32.dll
                    0 characteristics
             2AD092E4 time date stamp Mon Oct 05 12:09:24 1992
                 0.0 version
                   1 base
                 1F4 # functions
                  2F # names

            ordinal hint   name

                1F4    0   WEP
                 66    1   WSAAsyncGetHostByAddr
                 67    2   WSAAsyncGetHostByName
                 69    3   WSAAsyncGetProtoByName
                 68    4   WSAAsyncGetProtoByNumber
                 6B    5   WSAAsyncGetServByName
                 6A    6   WSAAsyncGetServByPort
                 65    7   WSAAsyncSelect
                 6C    8   WSACancelAsyncRequest
                 71    9   WSACancelBlockingCall
                 74    A   WSACleanup
                 6F    B   WSAGetLastError
                 72    C   WSAIsBlocking
                 6D    D   WSASetBlockingHook
                 70    E   WSASetLastError
                 73    F   WSAStartup
                 6E   10   WSAUnhookBlockingHook
                 61   11   __WSAFDIsSet
                  1   12   accept
                  2   13   bind
                  3   14   closesocket
                  4   15   connect
                 33   16   gethostbyaddr
                 34   17   gethostbyname
                  5   18   getpeername
                 35   19   getprotobyname
                 36   1A   getprotobynumber
                 37   1B   getservbyname
                 38   1C   getservbyport
                  6   1D   getsockname
                  7   1E   getsockopt
                  8   1F   htonl
                  9   20   htons
                  A   21   inet_addr
                  B   22   inet_ntoa
                  C   23   ioctlsocket
                  D   24   listen
                  E   25   ntohl
                  F   26   ntohs
                 10   27   recv
                 11   28   recvfrom
                 12   29   select
                 13   2A   send
                 14   2B   sendto
                 15   2C   setsockopt
                 16   2D   shutdown
                 17   2E   socket
```

Figure 1: **Using the Windows NT COFF utility with the -DUMP -EXPORTS switch generated this list of functions that WSOCK32.DLL exports.**

the last few issues so that it could be used to peer into a DLL and determine what functions it exports. Where would we start? Our past explorations have shown that any given NT executable file may contain a half-dozen or more relatively independent units called *file sections,* so our first job would be to figure out which of the sections contains the export table. Based on what we have already learned about the way Microsoft names sections, we could make an educated guess, but a top-down, brute force assault on the file structure would not be too difficult and will have the advantage of being unequivocal.

The first thing I needed was a DLL of manageable size that was known to work and thus could be assumed to have a valid export table. I looked through the WINNT\SYSTEM\ directory for all the files with the extension .DLL and picked WSOCK32.DLL because it was relatively small and yet supported a lot of different functions, so it should have a reasonably complex export table. (WSOCK32.DLL contains the entry points for the "WinSock" or "Windows Socket" functions, which are used for BSD Unix-like interprocess communication across a network.) I then used the Windows NT COFF utility along with the -DUMP -EXPORTS switches in order to generate the listing that is shown in Figure 1.

Next, I used the DUMP utility from my OS/2 book to produce a hex and ASCII dump of the WSOCK32.DLL file's binary contents on the printer, and visually inspected the dump for strings corresponding to the documented WinSock functions. Having found a clump of such strings, I looked through the section headers at the front of the file for a section whose addresses spanned the strings, then extracted the section name from the section header. The section name for the export table turned out to be .edata, logical enough considering that we already know the name of the import table section is .idata.

With this crucial information, I was in a position to attack the DLL's export table from the bottom up in a more elegant manner. The EXELOOK program already contained routines to open a file, map the file into memory, traverse the real mode (MZ) file header to the protected-mode (PE) header containing the COFF file header and optional header, and from there leap to the section headers that contain the names, characteristics, sizes, file offsets, and virtual addresses of each of the file's sections. It was straightforward to leverage this code and come up with a runtime pointer to the base of the .edata section. But that was the easy part. Having made the .edata section addressable, it was then necessary to make some sense of it.

At first glance, most of .edata is binary data without an obvious interpretation; for example, in the case of WSOCK32.DLL, the .edata section is ap-

IMAGE_EXPORT_DIRECTORY Structure

Complete Listing

```
//
// Export Format
//
typedef struct _IMAGE_EXPORT_DIRECTORY {
    ULONG   Characteristics;
    ULONG   TimeDateStamp;
    USHORT  MajorVersion;
    USHORT  MinorVersion;
    ULONG   Name;
    ULONG   Base;
    ULONG   NumberOfFunctions;
    ULONG   NumberOfNames;
    PULONG  *AddressOfFunctions;
    PULONG  *AddressOfNames;
    PUSHORT *AddressOfNameOrdinals;
} IMAGE_EXPORT_DIRECTORY,
  *PIMAGE_EXPORT_DIRECTORY;
```

Figure 2: **The structure declaration shown above was the crucial toehold that was needed to understand the contents of .edata. The .edata section has five components, as shown in Figure 3.**

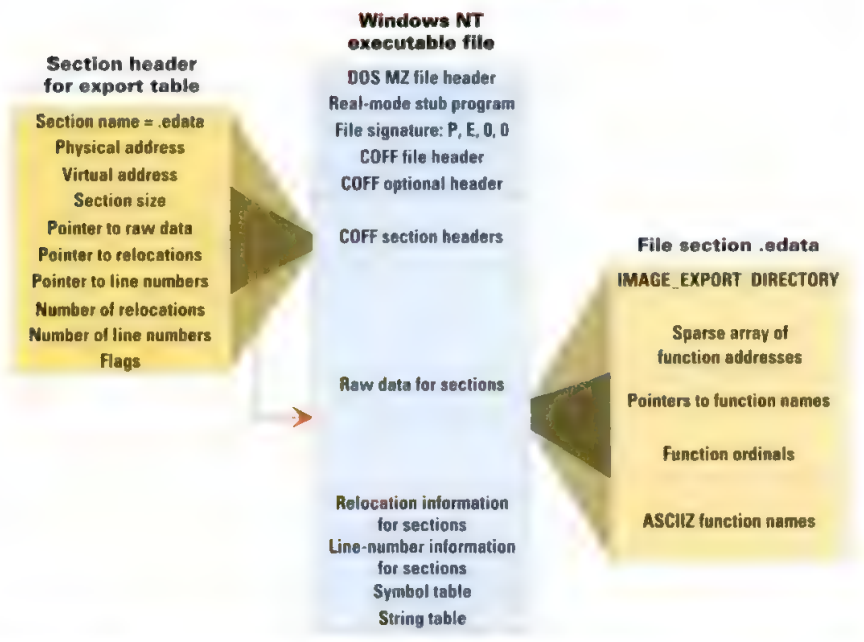


Figure 3: **A diagram of the stepwise location of the .edata file section and the components of that section.**

proximately 3K long, with only about 600 bytes of this data being recognizable function names. The only documentation in WINNT.H (or anywhere else in the Windows NT SDK, for that matter) that seemed applicable to the problem was the structure declaration shown in Figure 2. This is pretty spartan documentation by anyone's standards, but it turned out to be the crucial toehold that was needed to understand the contents of .edata. Comparing the output of the COFF utility that is shown in Figure 1 to the hex and ASCII dump of the WSOCK32.DLL file, it was clear that the .edata section begins with an instance of the IMAGE_EXPORT_DIRECTORY structure. The addresses in the last three fields of the structure were valid virtual addresses for .edata, which I corrected to file offsets with the aid of the contents of the section header for .edata. I then marked up the hex and ASCII dump of .edata with a pencil and determined that the section has five components, as you can see in the diagram shown in Figure 3.

The first part of .edata was, as I already said, the IMAGE_EXPORT_DIRECTORY structure. The second part appeared to be a sparse array of virtual addresses whose nonzero values lay within the range of addresses spanned by the DLL's .text (executable code) segment, so I speculated that these were the virtual addresses of the entry points for the exported functions. The third part was an array of virtual addresses whose values fell within the range of the .edata section. The fourth part was an array of 16-bit values, most likely ordinals (since they are too short to be addresses). And the final component was a packed array of ASCIIZ strings corresponding to the names of the exported functions, the entire set of strings being preceded by the name of the DLL itself. A few more minutes of inspection revealed that the virtual addresses in the third part of .edata pointed to the beginning of the function names in the fifth part.

I was now very close to an understanding of .edata that would be sufficient for

EXELOOK.C

1 of 2

```
//
// Extracts from EXELOOK.C - source code related to export table.
//
// ExeLook - Display Information about NT "Portable EXE" (PE) File
// Copyright (C) 1992 Ray Duncan
// PC Magazine * Ziff Davis Publishing
//

  .
  . various #defines and variable declarations omitted here
  .

PMZHEADER    pMZHeader;                    // pointers to header
PPEHEADER    pPEHeader;                 // structures within mapped
PCOFFHEADER  pCoffHeader;                  // executable file
POPTHEADER   pOptHeader;
PSCNHEADER   pFirstScnHeader;
PSCNHEADER   pIdataHeader;
PMODULEDIR   pIdata;
PSCNHEADER   pRsrcHeader;
PRSRCDIR     pRsrcDirectory;
PDATADIR     pDataDirectory;
PSCNHEADER   pEdataHeader;
PEXPORTDIR   pExportDirectory;

  .
  . various generic or previously-published routines omitted here
  .

//
// SetHeaderPtrs -- validates EXE file or DLL, sets up pointers
// to various structures and sections within the NT executable file.
// Called after the file has been successfully opened and mapped.
//
VOID SetHeaderPtrs(VOID)
{
    UINT i;                                  // scratch variables
    PSCNHEADER pCurScnHeader;

    // calculate address of DOS real mode (MZ) file header
    pMZHeader = (PMZHEADER) pMap;

    // calculate address of NT protected mode (PE) file header
    pPEHeader = (PPEHEADER) ((PBYTE) pMZHeader + pMZHeader->e_lfanew);

    if((pMZHeader->e_magic != IMAGE_DOS_SIGNATURE) ||
       (pPEHeader->Signature != IMAGE_NT_SIGNATURE))
    {
        MessageBox(hFrame, "Not a Windows/NT program or DLL!", szAppName,
            MB_ICONSTOP | MB_OK);
        CloseDataFile();
        return;
    }

    // calculate address of COFF File Header and Optional Header
    pCoffHeader = (PCOFFHEADER) &pPEHeader->FileHeader;
    pOptHeader = (POPTHEADER) &pPEHeader->OptionalHeader;

    // calculate address of data directory (embedded in Optional Header)
    pDataDirectory = (PDATADIR) &pOptHeader->DataDirectory;

    // calculate address of first section header
```

Figure 4: **Extracts from the source code of EXELOOK.C, showing the routines related to formatting and display of an export table.**

EXELOOK.C

2 of 2

```
pFirstScnHeader = (PSCNHEADER) ((PBYTE) pOptHeader +
                  pCoffHeader->SizeOfOptionalHeader);
// default = no sections found
pCurScnHeader = pFirstScnHeader;
pIdataHeader = NULL;
pIdata = NULL;
pEdataHeader = NULL;
pExportDirectory = NULL;
pRsrcHeader = NULL;
pRsrcDirectory = NULL;

// look through the section headers to find header for file section
// containing import table (.idata), export table (.edata), and
// resources (.rsrc).  For each section found, save address of
// section header and raw data.
for(i = 0; i < pCoffHeader->NumberOfSections; i++)
{
    if(!strcmp(pCurScnHeader->Name, ".idata"))
    {
        pIdataHeader = pCurScnHeader;
       pIdata = (PMODULEDIR) (pMap + pIdataHeader>PointerToRawData);
    }
    else if(!strcmp(pCurScnHeader->Name, ".edata"))
    {
        pEdataHeader = pCurScnHeader;
        pExportDirectory = (PEXPORTDIR) (pMap +
                           pCurScnHeader->PointerToRawData);
    }
    else if(!strcmp(pCurScnHeader->Name, ".rsrc"))
    {
        pRsrcHeader = pCurScnHeader;
        pRsrcDirectory = (PRSRCDIR) (pMap +
                         pCurScnHeader->PointerToRawData);
    }
    pCurScnHeader++;
  }
}
//
// ShowExports -- formats names, ordinals, hint values, and virtual
// addresses of exported functions for this module.
//
VOID ShowExports(VOID)
{
    ULONG i;                            // scratch variable
    UINT Hint = 0;                      // exported fxn position
    UINT * pFunctionList;               // pointer to pointer list
    PSTR pFunctionName;                 // pointer to name
    UINT * pFunctionAddr;               // pointer to virtual addr
    USHORT * pFunctionOrdinal;          // pointer to ordinal
    char temp[256];                     // formatting buffer

    if(pEdataHeader == NULL)            // bail if no export section
    {
        PostMessage(hFrame, WM_COMMAND, IDM_SECT, 0);
        return;
    }

    // extract virtual address of list of pointers to exported function
    // names from export directory, convert virtual to mapped address
    pFunctionList = (UINT *) ((PBYTE) pExportDirectory +
                    (ULONG) pExportDirectory->AddressOfNames -
                    pEdataHeader->VirtualAddress);

    // calculate mapped base address of table of function addresses
    pFunctionAddr = (UINT *) ((PBYTE) pExportDirectory +
                    (ULONG) pExportDirectory->AddressOfFunctions -
                    pEdataHeader->VirtualAddress);

    // calculate mapped base address of table of ordinals which have a
    // 1:1 correspondence to function names
    pFunctionOrdinal= (USHORT *) ((PBYTE) pExportDirectory +
                    (ULONG) pExportDirectory->AddressOfNameOrdinals -
                      pEdataHeader->VirtualAddress);

    // display title line
    wsprintf(temp, "%-32s Ordinal  Hint  Virt Addr", "Function Name");
    AddLine(temp);
    // now walk through the array of name pointers and display each name
    // along with function's ordinal, hint number, and virtual address
    for(i = 0; i < pExportDirectory->NumberOfNames; i++)
    {
        // convert virtual address of function name to mapped address
        pFunctionName = (PSTR) pExportDirectory + (ULONG) *pFunctionList -
                        pEdataHeader->VirtualAddress;

        // format and display information for this function
        wsprintf(temp, "%-32s  %04Xh  %04Xh  %08Xh", pFunctionName,
                 pExportDirectory->Base + *pFunctionOrdinal, Hint,
                 pFunctionAddr[*pFunctionOrdinal]);
        AddLine(temp);

        // advance to next name and corresponding ordinal
        // count exported functions for "hint" value
        pFunctionList++;
        pFunctionOrdinal++;
        Hint++;
    }
}
```

writing program code to display the section. Another look at the COFF-DUMP-EXPORTS output told me that the ordinals in the fourth part of the .edata section had a one-to-one relationship with the function names in the fifth part of the section, and that the Base field in the IMAGE_EXPORT_DIRECTORY structure (which contained the value 1) must be added to each of the values in the ordinal array to obtain the true ordinal. The final mystery was the sparse array. There were 47 nonzero values in the second part of the .edata section, 47 pointers in the third part, 47 ordinals in the fourth part, and 47 function names in the fifth part. Moreover, the size of the second part was exactly four times as many bytes as the highest ordinal value plus one. It turned out that the positions of the nonzero values in the second part corresponded to the ordinal values found in the fifth part—in other words, the second part of .edata is a lookup table of entry point addresses that is indexed by ordinal value.

We can now surmise how the system loader uses the export table to resolve a dynamic link. It uses the MZ and PE headers to find the section header for .edata, extracts the addresses from the section header to locate the file section .edata, uses the information that is in the IMAGE_EXPORT_DIRECTORY structure to find the names of the exported functions, searches the names sequentially until it finds a match for the desired function, retrieves the corresponding ordinal value from the fourth component of .edata, and uses the ordinal value as an index into the table of function addresses in the second part of .edata. It can then apply any necessary relocation to the address of the desired function and patch up the CALL instructions in the program that is dynamically linking to the DLL.

Given a few simple tools, knowledge of Windows NT's predecessors, and some understanding of how the system functions, there is little that you can't puzzle out eventually.

Aha, you might be thinking, but how will the system loader cope if some misguided programmer renames the .edata section? The NT file format provides an escape hatch for this situation. At the very end of the COFF optional header, in the implementation-specific area, there is a structure called the *data directory*, consisting of sixteen entries, each

Figure 5: **This screenshot shows the EXELOOK program in action.**

16-bytes in length. Each entry contains, among other things, the virtual address of a file section, and each position in the data directory has a predetermined significance. The first position in the data directory is reserved for a linkage to export data, if any exists in the file. So a system loader which looked through the section headers for a section named .edata and came up empty-handed could resort to the data directory, extract the virtual address from the first entry, search the section headers for a section with a matching virtual address, and proceed from there.

By this point you may be wondering why I've dragged you along on this little detective expedition. It's because I want you to feel confident that even in a complex system such as Windows NT, things are by necessity put together in a fairly reasonable way, and an absence of information about something that you want to do need never intimidate you. Given a few clues and simple tools, knowledge of Windows NT's predecessors, and some understanding of how the system functions, there is little that can't be puzzled out eventually, even in the absence of official support or proper documentation from Microsoft.

THE EXELOOK EXAMPLE PROGRAM Over the last two months, our EXELOOK example program has grown into quite a useful utility program. It now has the capability to format and display or print the following structures or information from any Windows NT application or DLL:

- MZ file header
- COFF file header
- COFF optional header
- Data directory
- Section headers
- Import table
- Export table
- Resource list
- Resource directory tree

The code that is specific to the display of the export table is shown in Figure 4, and a screen shot of EXELOOK in action is shown in Figure 5. The complete source code and executable program for EXELOOK can be downloaded from PC MagNet's Programming forum archived as EXELO3.ZIP.

THE IN-BOX Please send your questions, comments, and suggestions to me at any of these electronic mail addresses:
PC MagNet: 72241,52
MCI Mail: rduncan
Internet: duncan@cerf.net □

MOVING?

Please write to: PC Magazine, P.O. Box 54093, Boulder, CO 80322. Include your mailing label from a recent issue of PC Magazine for faster service. Please allow up to 60 days for change of address to take place.

DUSTIN DOES CD-ROM

Smart and Friendly

- Great Price on a fast, reliable drive.
- 2 Year Warranty!

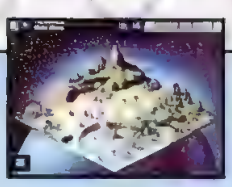
Get Bundle Prices on listed titles with purchase of CD-ROM Drive

CD-900 Series

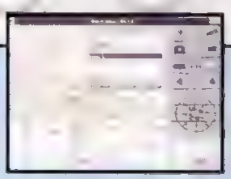
Data access: 375 MS
Data transferability: 150 KB/SEC
32 KB Memory Buffer • MPC Compliant

$309
internal

$59
Microsoft Cinemania
Everything you ever wanted to know about the movies
- 19,000 movie listings
- 3,000 biographies
- Dialogue and movie stills



$69
The Animals!
A multimedia adventure in the animal kingdom.
See and hear over 200 exotic mammals, birds and reptiles in terrific video/sound technology.



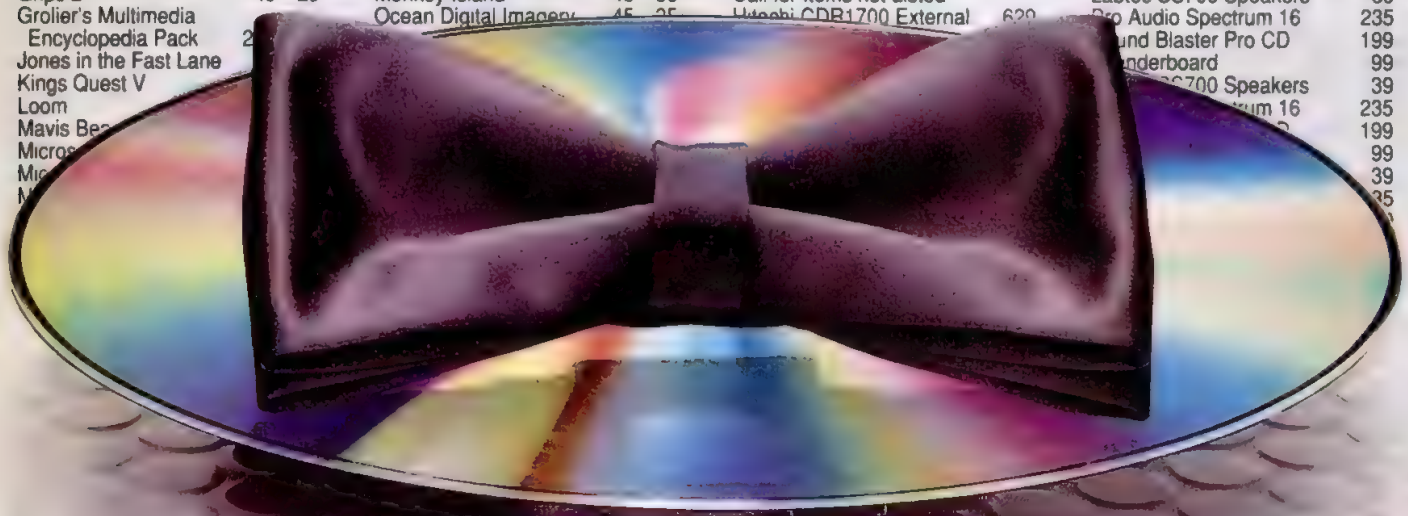
$99
Street Atlas USA
Detailed, street-level maps of the entire USA on one CD-ROM
Every street in the USA is included!
- Location by street name, phone exchange or zip code

Software	REG	BNDL
Amanda Stories MPC	49	35
Amer. Bus. Phone Book	NA	15
Animals, The	69	29
Annabel's Dream MPC	59	NA
Audobon's Mammals	39	15
Bible Library	59	15
Birds of America	39	15
Carmen San Diego	75	45
CD Game Pack II	59	35
CD Storytime Vol 1	NA	15
Chessmaster MPC	59	29
CIA World Fact Book	55	35
Corel Draw	399	NA
Corel Draw Vers Upgrd	145	NA
Corel Draw Comp Upgrd	235	NA
Desert Storm MPC	35	25
DTPro	NA	15
Great Cities/World	75	29
Grips 2	45	29
Grolier's Multimedia Encyclopedia Pack	2	
Jones in the Fast Lane		
Kings Quest V		
Loom		
Mavis Bea		
Micros		
Mic		
M		

	REG	BNDL
Grips 2	45	29
Grolier's Multimedia Encyclopedia Pack	265	NA
Jones in the Fast Lane	49	35
Kings Quest V	49	35
Loom	59	35
Mavis Beacon MPC	59	29
Microsoft Cinemania	59	NA
Microsoft Encarta	269	NA
Microsoft MM Beethoven	59	NA
Microsoft Bookshelf	139	NA
Microsoft Video	139	NA
Microsoft Works MM	139	NA
Microsoft Publisher	139	NA
Microsoft Office	499	NA
Mixed Up Mother Goose	49	35
MM Toolbook	535	NA
Monarch Notes	69	NA
Monkey Island	49	35
Ocean Digital Imagery	45	25

	REG	BNDL
Monkey Island	49	35
Ocean Digital Imagery	45	35
Playing with Language Series (each)	55	29
Publish It! 2.0	99	25
Shakespeare on Disc	29	15
Shareware Gold II	59	35
Sherlock Holmes	49	35
Sound Works	45	25
Stellar 7	49	35
Street Atlas USA	99	NA
Time Table of History	59	15
Toolworks Bundle Plus	NA	75
Toolworks Reference Lib	85	29
US Atlas MPC	NA	29
US Atlas w/Automap	59	45
Ultima I thru VI	89	49
World Atlas MPC	89	49
Call for Items not Listed		
Hitachi CDR1700 External	629	

Drives	BNDL
Hitachi CDR1700 External	629
Hitachi CDR3700 Internal	519
NEC CD Express	429
NEC CDR-74 External	649
NEC CDR-84 Internal	589
Smart & Friendly CD800 MAC	325
Smart & Friendly CD800e	299
Smart & Friendly CD900e	359
Smart & Friendly CD 900i	309
Smart & Friendly HS1200e	689
Smart & Friendly HS1200i	599
Sony CDU-535 Interface Kit	85
Sony CDU-535 Internal	319
Accessories	
Labtec SS700 Speakers	39
Pro Audio Spectrum 16	235
Sound Blaster Pro CD	199
Thunderboard	99
Labtec SS700 Speakers	39
Pro Audio Spectrum 16	235
und Blaster Pro CD	199
nderboard	99
700 Speakers	39
um 16	235
	199
	99
	39
	35



SAME DAY SHIPPING •
FREE GROUND SHIPPING

Monday thru Friday 6AM to 5PM PST

1-800-274-6611

20969 Ventura Blvd., Ste 13, Woodland Hills, CA 91364

DUSTIN
DISCOUNT SOFTWARE

Plain Wrap Prices,
Black Tie Service.

CIRCLE 168 ON READER SERVICE CARD

CALL FOR FREE CATALOGUE
& ANY ITEMS NOT LISTED

FAX your order 24-hours

1-818-884-5310

Prices subject to change without notice

PC DIRECT

The Purchasing Source for Direct Buyers

- *2,500 products to choose from*
- *Dozens of America's Top Direct Marketers*
- *Great Value for Your Money*
- *Service & Support Experts*
- *Fast Delivery*

INDEX

Systems

Ariel Design, Inc. 348
Comtrade 369
Edge/Micron 365
EPS Technology 352
Expo Tech 375
FASTMICRO 355
Insight Distribution Network 335
Keydata 350
Mitac 386
PCs Compleat 382
Quill Corporation 381
Tangent Computer, Inc. 346
Tri-Star Computers 364
USA Flex 370

Software/Peripherals/ Components

American Small Business 408
Arlington Computer Products 402
Buffalo Products 392
Bulldog Computer Products 412
Compuclassics 411
Computability 388
COMPUTER DISCOUNT WAREHOUSE.. ..... 398, 404
Computer Express 410
Dustin Discount Software 334,342
FASTMICRO 396
First Source International 413
H. Co Memory Upgrades 399
Insight Distribution Network 340
LA Trade 414
Midwest Computer Works 390
Pacific Wave 415
PCs Compleat 382
PC Zones 394
Peripheral Express 401
Publishing Perfection 409
Software Add-Ons 400
TELEMART 391,393

> ***Local bus PCs provide better peripheral performance, particularly for hard drives and video.***
>
> ***--PC Sources***
>
> *PC Sources*, January 1993 "Buying into Local Bus"

Insight 486 VESA Local Bus

Fully Upgradable Intel 80486CPU
2 VL-Bus Slots
4MB RAM - 128K Cache
210MB 12ms IDE Hard Drive
32 Bit Local Bus IDE Controller
32 Bit Local Bus 1MB Graphics Accelerator Super VGA Card
14" Non-Interlaced Super VGA Color Monitor
1.2MB 5.25" Floppy Drive
1.44 MB 3.5" Floppy Drive
2 Serial Ports, 1 Parallel Port
Enhanced 101 Key Keyboard
MS-DOS 5.0 - Mouse
Desktop Case, Full Vertical Available
Stacker & Dr. Solomon's Anti-Virus™ Software

486-33MHz
$1,949

486-50MHz
$2,149

486DX2-66MHz
$2,249

Note the extra row of pin holes. That's where the upgrade to Intel's OverDrive™ based on the Pentium™ architecture will go!

Based on Winmarks 2.5. Video performance varies with processor.

Standard VGA
2.0 Million

Paradise Accelerator
6.0 Million

Diamond Stealth
7.5 Million

Diamond Stealth 24
9.3 Million

Diamond Speedstar X
10.0 Million

ATI Ultra Pro
25.0 Million

Insight
51.3 Million

MULTIMEDIA UPGRADES

(Upgrade any PC)

Talon TA-100 Multimedia Kit

This easy-to-install kit comes complete with a Talon TA-100 internal CD-ROM drive (280ms access time, 32K buffer, 150KB transfer rate, photo CD compatible), plus SoundBlaster Pro® compatible sound board, amplified stereo speaker set, stereo headphones and installation manual. Free CD software includes: Toolworks MM Encyclopedia, Software Jukebox, Guinness Disk and Mayo Clinic. $249.95
(CD Software requires Windows)

Talon TA-200 Multimedia Kit

A complete, top-of-the-line multimedia kit including the Talon TA-200 CD-ROM Drive (280ms access time, multispin, 64k buffer, 300KB transfer rate, photo CD compatible), a SoundBlaster Pro® compatible sound board, amplified stereo speaker set, stereo headphones and manual. Free CD software inc.: Toolworks MM Encyclopedia, Software Jukebox, Guinness Disk, Animals, Nat'l Parks, Sherlock Holmes Detective and Mayo Clinic. $349.95
(CD Software requires Windows)

Pro Audio Spectrum 16 Sound Card

#1 selling 16 bit sound card! True 16 bit CD stereo sound, up to 44KHz. $179

Watch TV

Now you can watch TV on your PC monitor while working on other applications under DOS or Windows. $299

Multimedia is here. *You'll wonder how you got along without it!*

The Vision Series Insight VESA/EISA 486DX2-66MHz

- Fully Upgradable Intel 80486CPU
- 7 EISA Slots, 1 VESA/EISA Slot
- VL-Bus Video
- 16MB RAM - 256K Cache
- 520MB 12ms SCSI HDD w/cache
- 32 Bit Local Bus S3 1MB Graphics Accelerator Super VGA Card
- 32 Bit EISA SCSI Caching Controller with 2MB Cache
- **17" Non-Interlaced Super VGA Color Monitor**
- 1.2MB 5.25" Floppy Drive
- 1.44 MB 3.5" Floppy Drive
- 2 Serial & 1 Parallel Port
- Enhanced 101 Key Keyboard
- MS-DOS 5.0 - Mouse
- MS Windows 3.1
- Full Vertical Case Standard with 250 Watt Power Supply and Two Cooling Fans
- Stacker 2.0 and Dr. Solomon's Anti-Virus™ Software
- Talon TA-200 CD-ROM Drive
- Soundblaster Pro® Compatible Sound Board
- Amplified Stereo Speaker Set
- Watchit TV Board
- **25 CD-ROM Titles (Yes, 25 CD's!)**

486DX2-66MHz Multimedia

$5,999

The Vision Series Insight VESA VL-Bus 486-33MHz

- Fully Upgradable Intel 80486CPU
- VL-Bus Video
- 8MB RAM - 128K Cache
- 210MB 12ms IDE HDD w/cache 420MB with Stacker 2.0
- 32 Bit Local Bus S3 1MB Graphics Accelerator Super VGA Card
- 32 Bit VESA IDE Controller
- 15" Non-Interlaced Super VGA Color Monitor
- 1.2MB 5.25" Floppy Drive
- 1.44 MB 3.5" Floppy Drive
- 2 Serial & 1 Parallel Port
- Enhanced 101 Key Keyboard
- MS-DOS 5.0 - Mouse
- MS Windows 3.1
- Full Vertical Case
- Stacker 2.0 and Dr. Solomon's Anti-Virus™ Software
- Talon TA-150 CD-ROM Drive
- Soundblaster Pro® Compatible Sound Board
- Amplified Stereo Speaker Set
- 12 CD-ROM Titles

486-33MHz Multimedia

$2,999

The Vision Series Insight 486SX-25MHz Multimedia

- Fully Upgradable Intel 80486CPU
- 4MB RAM - 128K Cache
- 170MB 12ms IDE HDD w/cache 340MB with Stacker 2.0
- 15" Non-Interlaced Super VGA Color Monitor
- 24 Bit 1MB Graphics Accelerator Super VGA Video Card - up to 16 Million Colors
- 1.2MB 5.25" Floppy Drive
- 1.44 MB 3.5" Floppy Drive
- 2 Serial, 1 Parallel & 1 Game Port
- Enhanced 101 Key Keyboard
- MS-DOS 5.0 - Mouse
- MS Windows 3.1
- Desktop Case, Full Vertical Avail.
- Stacker 2.0 and Dr. Solomon's Anti-Virus™ Software
- Talon TA-150 CD-ROM Drive
- Soundblaster Pro® Compatible Sound Board
- Amplified Stereo Speaker Set
- 5 CD-ROM Titles

486SX-25MHz Multimedia

$2,099

FREE CD's with each Multimedia System!
Each bundle includes at least:
Toolworks Encyclopedia, Software Jukebox
Guinness Disk, Mayo Clinic & Animals

The Vision™ Series

Insight

Buy the Super Direct™ way!

Save your existing credit card lines. Get an Insight Credit Card!

Save your current credit card lines for a rainy day. Apply for your own Insight Credit Card. It's easy and, once you have it, shopping the Super Direct way becomes even more effortless. Call today. We'll even take your application by phone!

- Convenient
- No Annual Fee
- No Down Payment
- Low Monthly Payments

CREDIT CARD

Personal Purchases
Insight Credit Card

System cost:	Monthly Payments (1):
$1,000	$50
$2,500	$125
$5,000	$250

LEASING

Business Purchases
Insight Leasing

System cost:	Monthly Payments (2)
$1,000	$56
$2,500	$122
$5,000	$223
$5,000(3)	**$208**

(1) Insight credit card payments are based on 24 equal monthly payments.

(2) The above figures are for illustration only and are subject to change without notice. Leasing payments are based on a 24 month fair market value lease. Applicable sales tax is not included in the payment figure. Leases are non-cancelable and may require a deposit.

(3) Based on zero percent interest. Offer only good until March 31, 1993. All other conditions apply. (Zero percent interest only applies to leases greater than $3,000)

Compared to Insight's lightning-fast hard drive and video speed ... everything else runs in slow motion!

Why settle for slow video *or* sluggish hard drive performance? With Insight's new VESA VL Bus system you don't have to. Standard with both a 32-bit local bus video card and a 32-bit local bus IDE hard drive controller, you'll get top performance in the areas that matter most -- video and hard drive. In fact, with Insight's local bus 32-bit IDE controller, you can expect up to a 400% increase in hard drive performance!

Comparison based on sequential read tests performed on a 16-bit controller and the new VESA-based IDE 32-bit controller.

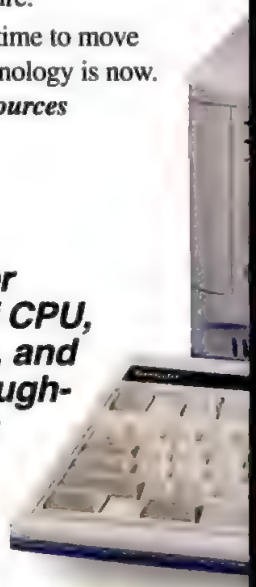
When it comes to computer graphics, Insight's video performance goes off the chart -- nearly double that of our nearest competitor.

With VESA local bus video and hard drive, even the most graphic-intensive programs will pop onto your screen, and your numbers will crunch at awesome speed. How? Peripherals running from adapters on the CPU's local bus run at *full clock speed* rather than 8 or 12MHz as on a 16-bit ISA bus. The results are mind-boggling.

What's more, the Insight VL Bus is upgradeable. You'll be current with technology right up through the next generation with our 238-pin ZIF (Zero Insertion Force) OverDrive™ Socket for Intel's next generation processor, based on the Pentium™ architecture.

So you see, the time to move up to the latest technology is now. According to ***PC Sources*** magazine,

> ***"A better balance of CPU, hard drive, and video throughput means better overall applications performance."***
>
> ***-PC Sources***
>
> *PC Sources*, January 1993 "Buying into Local Bus"



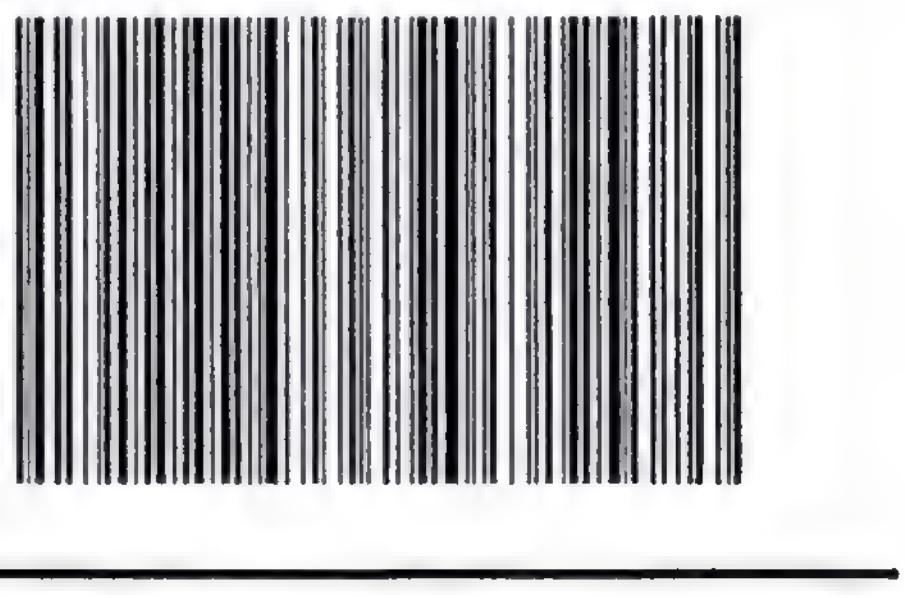
Why wait to break the information bottleneck? Call us today and we'll get you up to speed. *Fast.*

Insight **Buy the Super Direct™ way!**

800-927-2906

Fast, Safe Federal Express Delivery!

Folded edge of the page

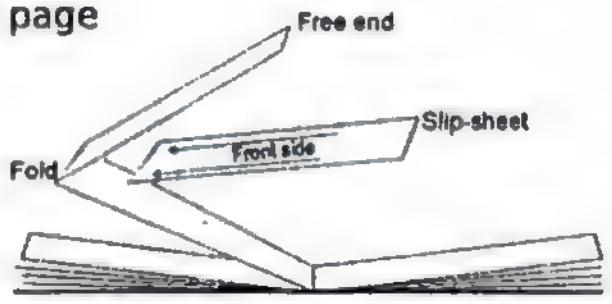


Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Back

1. Follow instructions on the other side

GbsSlipBack-0018

Back

1. Follow instructions on the other side

Insight Super Direct.™

BETTER FASTER CHEAPER

WHAT MORE IS THERE?

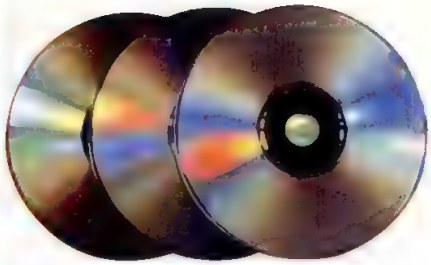
The best selection (over 25,000 items in our warehouse) of some of the most important brand names in computers, hardware and software.

■ Insight's own astonishing 486 VESA/EISA and VESA VL-Bus systems. ■ Rock bottom prices. ■ Toll-free technical support, seven days a week. ■ Fast Federal Express delivery. ■ Free software with many systems and peripherals. ■ 30-Day Worry-Free Guarantee. ■ One-year warranty/ replacement policies. ■ 24-hour ordering, seven days a week. ■ Knowledgeable, courteous salespeople. ■ Wide variety of payment options.

It's clear. The best deals start and end the Super Direct™ way. With Insight, the superstore at your doorstep!

800-927-2906

Insight Buy the Super Direct™ way!®



MAGNETO OPTICAL

FUJITSU M2511A MO Disk Drive

Insight brings you the new Fujitsu 3.5" magneto optical disk drive. A low cost solution for fully rewritable, removable and reliable storage. The MO is your ideal solution for back-up, transportability and archiving of large files or large data bases in a sleek 1" vertical size.

And as you acquire the 128MB removable and rewritable cartridges, your cost per megabyte plummets. MO is definitely better! ***$999***

- Rewritable
- Reliable Media
- Inexpensive Optical Cartridges
- Fast
- Easy to install

Drive Kit Includes:
- DTC 3150 Controller
- Cabling
- MO 128MB Disk Cartridge

Features:
• Low Profile - only 1" high • Fixed optics • Fast rotational speed 3600 rpm • Embedded SCSI - 2 controller • ISO standard format • Partial and O-ROM capability.

15" MONITOR

HITACHI NSA SuperScan™ 15 CM1584

MPR II certified, 15" flat, square screen, 1024x768 non-interlaced, .28 dp. Perfect for windowing, business graphics, multimedia and 24-bit imaging and rendering. ***$499***

HARD DRIVES

HARD DRIVES International

Compare! All of our drives come as complete kits.

All bare drive kits include:

Quality Hard Drive, Complete mounting kit (3.5" kits inc. 5.25" bezel), All mounting hardware (including screws), HDI's own Hard Drive Reference Manual, Step-by-step installation instructions.

All 8 Bit (PC/XT) kits include:

Quality Hard Drive, Controller (when applicable), Complete mounting kit (3.5" kits inc. 5.25" bezel), All mounting hardware (including screws), Cable, & HDI's own Hard Drive Reference Manual Step-by-step installation instructions.

All 16 Bit (286/386/486) kits include:

Quality Hard Drive, 16 Bit 1" to 1" interleave hard/floppy controller, or appropriate interface, Complete mounting kit (3.5" kits inc. 5.25" bezel), All mounting hardware (including screws), Cable, & HDI's own Hard Drive Reference Manual Step-by-step installation instructions.

PC MAGAZINE EDITORS' CHOICE

Buy from a recognized leader.

Brand names, low prices

From the storage experts!

Western Digital

Free Stacker with all Western Digital Hard Drives. Stacker instantly and safely doubles your hard disk capacity!

WESTERN DIGITAL

125MB / 250MB w/ Stacker 2.0 — IDE

Western Digital WD2120A, 14ms 3.5" 1"H	
Bare Drive Kit	$289
8 Bit Kit	$329
16 Bit Kit	$309

170MB / 340MB w/ Stacker 2.0 — IDE

Western Digital WD2170A, 12ms 3.5" 1"H	
Bare Drive Kit	$299
16 Bit Kit	$319

210MB / 420MB w/ Stacker 2.0 — IDE

Western Digital WD2200A, 12ms 3.5" 1"H	
Bare Drive Kit	$379
16 Bit Kit	$399

250MB — IDE

Western Digital WD2250A, 12ms 3.5" 1"H	
Bare Drive Kit	$429
16 Bit Kit	$449

340MB / 680MB w/ Stacker 2.0 — IDE

Western Digital WD2340A, 12ms 3.5" 1"H	
Bare Drive Kit	$589
16 Bit Kit	$609

WESTERN DIGITAL

Fujitsu

420MB — IDE/SCSI

Fujitsu FJ2623A/S, 12ms 3.5" HH	
Bare Drive Kit	$849
16 Bit Kit (IDE)	$869
16 Bit Kit (SCSI)	$999

510/520MB — IDE/SCSI

Fujitsu FJ2624A/S, 12ms 3.5" HH	
Bare Drive Kit	$899
16 Bit Kit (IDE)	$919
16 Bit Kit (SCSI)	$1,049

1080MB — SCSI

Fujitsu FJ2266S, 14.5ms 5.25" FH	
Bare Drive Kit	$1,399
16 Bit Kit	$1,549

Seagate

42MB — IDE

Seagate ST351A, 28ms 3.5" 1"H	
Bare Drive Kit	$149
8 Bit Kit	$189
16 Bit Kit	$169

106MB — IDE

Seagate ST3120A, 15ms 3.5" 1"H	
Bare Drive Kit	$249
8 Bit Kit	$289
16 Bit Kit	$269

245MB — IDE/SCSI

Seagate ST3283A/N, 12ms 3.5" 1"H	
Bare Drive Kit (IDE)	$479
Bare Drive Kit (SCSI)	$529
16 Bit Kit (IDE)	$499
16 Bit Kit (SCSI)	$679

Micropolis

660MB — SCSI

Micropolis MC1624, 15ms 5.25" HH	
Bare Drive Kit	$1,179
16 Bit Kit	$1,329

1350MB — SCSI

Micropolis MC1528-15, 14ms 5.25 FH	
Bare Drive Kit	$1,749
16 Bit Kit	$1,899

Maxtor

130MB — IDE

Maxtor MX7120A, 15ms 3.5" 1"H	
Bare Drive Kit	$279
16 Bit Kit	$299

210MB — IDE

Maxtor MX7213A, 15ms 3.5" 1"H	
Bare Drive Kit	$379
16 Bit Kit	$399

Conner

40MB — IDE

Conner CP3000, 25ms 3.5" 1" H	
Bare Drive Kit	$169
8 Bit	$209
16 Bit Kit	$189

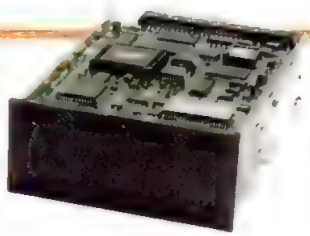
170MB — IDE

Conner CP30174A, 17ms 3.5" 1"H	
Bare Drive Kit	$319
16 Bit Kit	$339

Talon

120MB / 240MB w/ Stacker 2.0 — IDE

Talon TA3020A, 16ms 3.5" 1" H	
Bare Drive Kit	$249
8 Bit Kit	$289
16 Bit Kit	$269



If you don't see what you need, call!

Storage solutions. *Reliable, fast and economical.*

HARD DRIVES *International*

Tape Backups

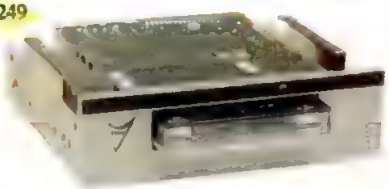
Talon™ by Colorado SUPER BUY!

120MB inc. one tape $189
250MB inc. two tapes $249

Standard QIC 80 attaches to existing floppy controller or dedicated unit, w/ data compr. 2-3MB/min.

Colorado

120MB $199 250MB $259



WangDAT

DAT Tape Backups SUPER BUY!

WangDAT is the premier name in Digital Audio Tape backup systems. These compact units offer the speed and reliability necessary for high capacity tape storage for DOS, Novell and UNIX-based systems. Now Super Direct™ Priced!

Internal kits - 3.5" with 5.25" frame, 16 Bit controller card, cable, software, mounting hardware and tape included.
External kits - external case, 16 Bit controller card, cable, software, SCSI interface, tape included.

2GB 3100 Internal 16 Bit Kit $1,199
4GB 3200 Internal 16 Bit Kit $1,399
4GB 3200 External 16 Bit Kit $1,499

Bernoulli by IOMEGA

Your drive will grow with you if you change systems or platforms. And, only Bernoulli is endorsed by 99 percent of its owners!

Bernoulli features a 75,000-hour MTBF rate, proven head-crash resistance and disks that withstand an eight-foot drop! Up to 360MB with Stacker® 2.0.

360MB Removable Media Kit

Bernoulli, the best name in removable media, offers a 90 Pro internal drive, full SCSI adapter, up to 360MB of storage, 2 90MB cartridges and Stacker® 2.0 disk compression software.

360MB Internal Kit $499
Extra Cartridges $149
Tri-Pack Cartridges $419

Each drive includes 2 cartridges!

BERNOULLI MEANS SECURITY FOR YOUR DATA

Other Iomega Products

PC Powered 90 Pro Kit $599
MacTransportable Kit $499
PC2B Interface Card $159

CD-ROM *Ask about multimedia kits!*

Talon SUPER BUY! TA-100

Internal, 380ms access time, 32KB buffer, fast transfer rate, headphones and software. Photo CD compatible. $279

Talon TA-150

Int, 375ms access time, 32KB buffer, fast transfer rate, headphones and software. Photo CD compat. $309

Talon High Performance TA-200

Internal, 280ms access time, 64KB buffer, 300KB/second transfer rate, headphones and software. $549

*Free with Talon CD-ROM drives-

New 1992 Toolworks Multimedia Encyclopedia
21 volume set. 33,000 articles w/3,000 pictures, 250 maps, 35 min. of video, 35 min. of sound and 55 video sequences.

Guiness Disk
The tallest man, the longest car. 7,000 record-breakers illustrated with over 300 photos and 70 sound clips!

Software Jukebox
Fly an F-117 Stealth with Jet Fighter! Three award-winning games for the price of one. Also includes 50 demos and Berenstain bears coloring program.

CD Stereo Headphones

CD Software - Pick 5 for $99*

**with purchase of a Talon CD-ROM Drive or mm kit*

Aircraft Encycl.	European Monarchs	N. American Indians	Space-Apollo
Am. Bus. Phone Book	Family Choice	Nat'l Parks	Timetable Sci.
Bible Library	Guiness Disc	Officer's Bookcase	USA State Factbook
Career Opportunities	Great Cities (MM)	Plant Doctor	US Civics
CIA/KGB Factbook	Interactive Storytime	Publish it! w/clip art	US Presidents
Civil War	Klotski for Windows	RBBS in a box	World/U.S. Atlas
Coates Impressionism	Korea	Sherlock Holmes	Vietnam
Desert Storm	Mavis BeaconTyping	Solar System	World War II

Expand your view

When you need monitors, think Insight!

Insight SUPER BUY!

Insight 15" 1024x768 high-resolution perfect-view video. Non-interlaced. $429

Hitachi NSA

SuperScan 15" CM1584 $499
SuperScan 17" CM1785 $999
SuperScan 20" CM2085 $1,399

NEC

MultiSync 3FGx 15" $639
MultiSync 4FG 15" $749
MultiSync 5FG 17" $1,349
MultiSync 6FG 21" $2,359

Insight Distribution Network, Inc.
1912 W. 4th St., Tempe, AZ 85281
602-350-1176
Sales FAX 602-350-1150
Corporate - Gov't - Educational
800-927-2907
APO/FPO/International
602-350-1145
FAX 602-350-1188

800-927-2906

Insight

Buy the Super Direct™ way!

Prices and availability subject to change without notice. All items are NEW. POs accepted from qualified buyers- Net 30. APO/FPO orders add $16 for US Post Express Mail. POs, 30-Day Guarantee and 1-Year Replacement Policy may have some restrictions. Shipping is non- refundable. All trademarks are the properties of their respective owners. Intel Inside is a registered trademark of Intel Corporation. Leasing available for businesses. 3/30/93.

No strings attached.

ACC PAC BPI Series ●	CALL
ACC PAC Simply Accounting ● ■	135
Budget Express ●	109
DAC Easy Accounting 4.3 ●	105
DAC Easy Accounting Upgr. ●	49
DAC Easy Bonus Pack ●	135
DAC Easy Instant Accounting ●	39
DAC Easy Payroll 4 3 ●	69
DAC Easy Point of Sale ●	99
Home Lawyer ●	55
Individual Stock Investor ●	69
Master Accounting Jr. ●	49
MS Money ■	55
Peachpay ●	55
Peachtree Accounting ■	85
Peachtree Complete ●	195
Quickbooks ●	95
Quicken 2.0 ■	49
Quicken 6.0 ●	49
Quickpay ●	65
Turbo Tax Federal ● ■	CALL
Turbo Tax State ● ■	CALL

ABC Flowcharting ■	209
CA Cricket Paint ■	99
Cricket Graph ■	89
Cricket Presents ■	129
WP Presentation ■	295
Formfiller 3.0 ●	89
Formtool Gold 3.0 ●	65
Freelance Graphics ● ■	349
Freelance Graphics Upgrade ● ■	109
Harvard Graphics ●	409
Harvard Graphics ■	369
Labels Unlimited ●	69
MM Make Your Point ■	75
Perform ■	195
Powerpoint For Windows ■	325
Stanford Graphics ■	359
Visio ■	199

Autosketch 3.0 ●	155
Design CAD 2D ●	185
Design CAD 3D ●	259
Design CAD Professional ●	595
Design Your Own Home Series ●	CALL
Drafix CAD ■	439
Drafix CAD Ultra ●	259
Easy CAD 2 ●	109
Fast CAD ●	419
Generic 3D Drafting ●	215
Generic CAD 6.0 ●	259
Generic Home Series ●	CALL

WINfaxScan/Printer ★	59
Blast Professional ●	89
Blast Remote for Procomm ●	29
Carbon Copy Plus ● ■	145
Co Session ● ■	105
Crosstalk 2.0 ■	129
Hyp	49
Hyp	75
	135

Crosstalk 2.0 ■	129
Crosstalk Communicator ●	49
Hyperaccess 5 ●	75
Hyperaccess 5 ◆	135
Lantastic Products ● ■	CALL
Laplink Pro 4.0 ●	109
Laplink Pro Upgrade ●	59
Novell Products ●	CALL
PC Anywhere 4.5 Host/Rmt ●	119
Procomm Plus ●	79
Procomm Plus ■	89
Q-Modem Pro ●	69
Remote 2 (Host & Caller) ●	119
Smartcom III ●	119
Wildcat BBS ●	89
Windows For Workgroups ■	CALL
Winfax Pro ■	95
WordPerfect Office PC ●	95

Access ■	99
Acefile ■	195
Approach ■	169
Approach Comp. Upgrade ■	155
CA Clipper ●	499
CA Clipper Tools ●	469
CA Compiler Kit-dBase IV ●	799
CA Ret/XBase ■	195
Clarion Personal Developer ●	55
Clarion Professional ●	479
DataEase Express ■	115
DataPerfect ●	295
DB Fast ■	339
dBase IV ●	519
FileMaker Pro ■	269
Foxbase + LAN ●	305
Foxbase + LAN Runtime ●	349
Foxbase + S/U Runtime ●	249
Foxbase Plus ●	275
Foxpro 2.0 ●	519
Foxpro 2.0 6-User Pack ●	585
Foxpro 2.0 Distribution Kit ●	329
Instant Database ■	55
Paradox ● ■	549
Paradox LAN Pack ●	CALL
Paradox Upgrade ●	179
PC-File ●	■
Q & A 4.0 ●	265
R&R Report Writer 4.0 ●	195
Rbase ●	CALL
Rbase ◆	635
Rbase 3.1 LAN Pack ●	595
SCO Foxbase ●	CALL
Superbase 2.0 ■	469

By Design for WP ● ■	65
Catchword ●	145
Corel Draw 3.0 ■ ◆	389
Corel Draw 3.0 Comp. Upgrade ■	179
Corel Draw 3.0 Upgrade ■	145
Cricket Paint ■	99
Discovery Font Pack ■	39
Express Publisher ● ■	109
Facelift For WP ●	69
Fontmonger ■	105
Freedom Of The Press ■	
Freehand ■	
Infinitype S	

Fontmonger ■	105
Freedom Of The Press ■	255
Freehand ■	405
Infinitype Plus ● ■ ◆	55
Make Up ■	105
More Fonts ● ■	79
Newsmaster II ●	55
Omnipage 386 3 0 ■	459
Omnipage Pro ■	649
Pagemaker ■	529
PFS Publisher ■	89
PFS:First Graphics ●	
Postscript Cartridge ★	
Printshop Deluxe ●	
Publish It ●	
Publisher ■	
Masterpiece True	
Upgrade True Ty	
Ventura Publisher	
Automap ● ■	
Automap Europe ●	
Body Works ●	
Chemistry Works ●	
DINE Right for Windows ■	
Distant Suns ■	
Home Medical Advisor ●	
French Assistant 5.0 ●	
German Assistant 5.0 ●	
Italian Assistant 5.0 ●	
Jet Fighter II ●	
Kid Pix ● ■	
Knowledge Adventure	
Orbits ●	
PC Globe ● ■	
PC Study Bible ●	CALL
PC USA ●	35
Personal Training Systems ● ■	CALL
Science Adventure ●	49
Space Adventure ●	49
Spanish Assistant 5.0 ●	59
Sports Adventure ●	49
The Playroom ●	35
The Treehouse ●	45
Typing Tutor VI ● ■	39
Vista Pro ●	75
Where is Carmen Series ●	CA
A-Train ●	
Entertainment Pack (MS) ■	
Falcon 3.0 ●	
Flight Simulator 4.0	
Flightstick ●	
Go Master ● ■	
Go Master Deluxe	
Jack Nicklaus	
Links. The	
Play	
S	
S	49
Te	45
	29
	39
	89
	55
D.	
Ge	

1st Act ●	59
Art! ● ■	CALL
Address Book Plus ●	65
Ascend ■	179
CA Super Project ■	499
CA Up To Date ■	99
Calendar Creator ■	49
Daybook Plus ■	45
Descriptions Write	65
Info Select 2.0 ● ■	99
Lotus Organizer ■	99
Manage Pro ■	239
Target ■	269
■	85
●	49
Rat ■	249
Write	109
●	329
■	

Dustin delivers.

Space Adventure ●	49
Spanish Assistant 5.0 ●	59
Sports Adventure ●	49
The Playroom ●	35
The Treehouse ●	45
Typing Tutor VI ● ■	39
Vista Pro ●	75
Where is Carmen Series ●	CALL
[illegible]	
A-Train ●	49
Entertainment Pack (MS) ■	CALL
Falcon 3.0 ●	55
Flight Simulator 4.0 ●	49
Flightstick ●	55
Go Master ● ■	45
Go Master Deluxe ● ■	115
Jack Nicklaus Unlmtd Golf ●	45
Links: The Challenge Of Golf ●	45
Playmaker Football ●	39
SimCity ● ■	39
SimEarth ● ■	49
Test Drive III - The Passion ●	45
Tetris ● ■	29
Ultimate Golf ●	39
[illegible]	
Apprentice ■	89
Clickart Business Images ● ■	55
Designer ■	469
Dr. Halo IV ■	79
Gem Draw Plus ●	179
Graphics Editor ■	399
Halo Desktop Imager ■	89
Harvard Draw Upgrade ■	CALL
Harvard Draw ■	189
Hijaak ● ■	135
Illustrator ■	389
Image Pals ■	129
New Printshop ●	45
Photofinish ■	129
Photostyler ■	549
Publishers Paintbrush 2.0 ■	295
Windows Draw ■	99
[illegible]	
1st Act ●	59
Act! ● ■	CALL
Address Book Plus ●	65
Ascend ■	179
CA Super Project ■	499
CA Up To Date ■	99
Calendar Creator ■	49
Daybook Plus ■	45
Descriptions Write Now ●	65
Info Select 2.0 ● ■	99
Lotus Organizer ■	99
Manage Pro ■	239
On Target ■	269
On Time ■	85
On Time ●	49
Pack Rat ■	249
Policies Write Now ●	109
MS Project ●	329
MS Project ■	455
Timeline ●	485
[illegible]	
Lotus Works ●	99
MS Office Windows	489
Simply Business Bundle ■	425
PFS:Fir[illegible]	99
[illegible]	30

Smart Suite ■	469
Smart Suite Upgrade ■	349
Stepway ■	55
Symphony 2.2 ●	515
Works ■	139
Works ●	105
[illegible]	
Derive 2.0 ●	155
Mathcad 3.0 ■	319
Mathmatica 386/387 ■	849
Statgraphics 5.1 ●	689
Systat Dual ●	745
[illegible]	
Courier Dual Standard Modem ★	CALL
Courier HST 16.8 Ext. ★	655
Courier HST 16.8 Int. ★	575
ESP	189
Hayes Smartmodems ★	CALL
Modem Sharing Kit ★	679
Optima 144 + Fax 144 ★	499
Optima 24 + Fax 96 ★	175
Optima 96 + Fax 96 ★	399
PM14400FX Send/Rec Fax ★	389
PM2400 V.42BIS ★	129
PM2400FX96 Send/Rec Fax ★	109
PM2400PPM Pocket Modem ★	119
PM2400PPm Pocket W/Fax ★	169
PM9600 V.32/V/42 BIS ★	299
Pocket Edition 2400 ★	115
Sportster 9600 ★	319
Ultra 144 ★	CALL
Ultra 96 ★	699
WorldPort 2400 ★	149
WorldPort 9600 ★	419
[illegible]	
Labtec SS-700 Speakers ★	39
Sound Blaster ★	115
Sound Blaster Pro ★	199
Sound Blaster Pro 16 ★	249
Pro Audio Spectrum Plus ★	145
Pro Audio Spectrum 16 ★	209

Call for great bundle prices on CD-ROM drives and software. We have hundreds of CD titles in stock.

[illegible]	
Desqview 2.4 ●	85
Desqview 386 ●	139
Desqview X ●	179
Dr. DOS Multiuser 5.1 ●	489
Geoworks Pro ●	135
MS DOS 5.0 ●	75
MS DOS 5.0 Upgrade ●	75
New Wave ■	119
OS/2 ◆	155
OS/2 Upgrade ◆	109
PC DOS 5.0 ●	149
PC DOS 5.0 Upgrade ●	69
PC MOS 5 User ●	429
PC Mos Single User ●	155
SCO Unix/Xenix	CALL
Windows 3.1 ■	99
Windows 3.1 Upgrade ■	59
[illegible]	
Audioman ★	CALL
Ballpoint Mouse ★	129
Ballpoint Mouse W[illegible]indows 3 [illegible] ★	149
[illegible]	105
[illegible]	559

Expert Mouse ★	105
Fotoman ★	559
[illegible] ★	79
MS Mouse ★	89
MS Mouse w/Windows 3.1 ★	165
Scanman Mode 256 ★	275
Trackman Portable ★	109
Trackman Serial ★	59
[illegible]	
Borland C++ ● ■	349
Borland C++W/App ● ■	519
MS C Compiler ●	329
Data Boss ●	349
Install Boss ●	69
MS Macro Assembler ●	105
Multimedia Toolbook ■	529
OS/2 Pres Mgr Toolkit ◆	335
Quick Basic ●	75
Quick C ●	75
Smalltalk ■	299
Smalltalk V ●	85
Toolbook ■	299
Turbo C++ ■	115
Turbo C++ ●	75
Turbo Pascal 7.0 ●	CALL
Visual Basic ● ■	139
Visual Basic Pro.Toolkit ● ■	CALL
Windows Development Toolkit ■	325
Zortech C++ ●	475
[illegible]	
123 for Home ●	99
CA Compete ■	CALL
Excel ■ ◆	319
Excel Comp. Upgrade ■	129
Excel Version Upgrade ■	99
Lotus 123 Upgrade ■	99
Lotus 123 V3.4 ●	419
Lotus 123 ■	349
Lotus123 V2.4 ●	349
PlanPerfect ●	245
Quattro Pro ● ■	319
Quattro Pro Upgrade ● ■	145
Supercalc ●	99
[illegible]	
386 Max ●	69
After Dark Windows ■	35
Back It 4 ●	85
Back It 4 Windows ■	55
Check It ●	89
Copy II Deluxe Option Board ●	115
Copy II PC 6.0 ●	39
Direct Access ● ■	59
Fastback Plus ● ■	109
File Runner ●	85
Label Pro - Laser ●	55
Mac in Dos ● ■	99
Menu Works Advanced ●	65
MS Productivity Pack ■	49
Mac in Dos ● ■	99
Menu Works Advanced ●	65
MS Productivity Pack ■	49
Netroom ●	69
Norton Antivirus ● ■	95
Norton Back-Up ● ■	95
Norton Desktop ● ■	119
Norton Utilities ●	119
PC Kwik Powerpak ●	85

PC Tools Deluxe 8.0 ● ■	139
Pizazz Plus ●	85
PK Zip ●	55
Print Cache ●	99
Print Q 6.0 ●	99
Q DOS III ●	55
QA Plus ●	99
QEMM 386 ●	65
QRAM ●	55
SPF/2 ◆	179
SPF/PC ●	195
Spinrite II ●	69
Stacker 3.0 ● ■	99
Stacker Upgrade ● ■	59
Star Trek Screen Saver ■	45
Super PC Kwik ●	55
Superstor Pro ● ■	95
Virex PC ●	69
Virusafe ●	69
Virusafe LAN ●	399
Winmaster ■	CALL
X Tree ■	75
X Tree Gold 2.5 ●	99
[illegible]	
Ami Pro V3 0 ■	249
Ami Pro V3.0 Upgr ■	CALL
CA Textor/Grammatic Bndl ■	99
Grammatik ● ■	69
LetterPerfect ●	99
Lotus Write ●	135
MS Word ●	229
MS Word ■ ◆	319
MS Word Upgrade ■	129
PFS:Write ●	85
Professional Write ● ■	175
Rightwriter ● ■	65
Screen Extender For WP ●	65
Wordperfect ◆	CALL
WordPerfect ● ■	279
WordPerfect MLP ● ■ ◆	CALL
WordPerfect Upgrade ● ■	CALL
Wordstar ●	285
Writers Toolkit ●	89

DOS ● WINDOWS ■ O/S2 ◆ HARDWARE ★

DUSTIN
DISCOUNT SOFTWARE

Plain Wrap Prices, Black Tie Service.

20969 Ventura Blvd., Woodland Hills, CA (818) 710-9174

Call Toll Free from anywhere in the United States

Mon thru Fri 6AM to 5PM, Sat 10AM to 2PM PST

1-800-274-6611

Or Fax Your Order!

1-818-884-5310

We will promptly replace any defective items returned within 30 days, but cannot guarantee compatibility. There is a 15% restocking fee on any non-defective, unopened goods, and all returns must be accompanied by a Returned Merchandise Authorization. Software prices do sometimes fluctuate beyond our control and may change, for better or worse, without notice. While ground shipments are free, we do ask $11.00 per item for 2-day, $22.00 per item for overnight, and $4.50 for C.O.D. Although shipping heavier items may be slightly more, bulk orders can be a lot less. Free catalogues are available upon request, and please call us for any item not listed.

CIRCLE 347 ON READER SERVICE CARD

DIFFERENCE

Call for Any Item Not Listed

No Credit Card Surcharges • 24-Hour FAX Order-Line • Latest Versions

•Thousands of Items in Stock • Manufacturers' Warranties & Documentation • Call for Free Catalogue

Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

PCs

WINDOWS WITHOUT DISKS

❓ My new computer came with Windows, but no disks. When I try to install a printer, the program asks for the Windows disks. What do you think I should do, short of buying another Windows package?

David Oglesby
via CompuServe

▶**PC MAGAZINE:** Some vendors, such as Microsoft, have licensing agreements with the OEM whereby they don't have to provide distribution disks for each copy of a program they sell. However, most of these vendors install the disks on the hard drive in a separate directory (WINSTALL, for example). This directory contains all the drivers and files included on the disks, and you can create your own set simply by copying the files onto floppy disks. But if you keep a full backup of the directory in case there are any problems, there's really no need to have the files on floppy disks. If you can't find the installation files on your computer, ask your vendor.

It's relatively easy to install new printer or display drivers from this directory. When the Windows setup program asks you to insert a Windows disk, it also allows you to change the drive and path. So simply enter the drive and directory where the installation files are located, and the setup program should work fine.—*Alfred Poor*

KEEPING BATTERIES CHARGED

❓ If I leave my notebook computer turned off for ten days or so, the battery runs down so completely that I have to reconfigure the machine. Should I leave it plugged into the battery charger all the time, even though I may not be using it for extended periods?

J. Glenn Sperry
South Haven, Michigan

Our Advisors

Douglas Boling is a contributing editor and the author of many utilities, including MBOOT.COM and EMS40.SYS.
Frank J. Derfler, Jr., is senior networking editor and the author of the *PC Magazine Guide to Connectivity.*
Alfred Poor is a contributing editor and the author of the *Hewlett-Packard LaserJet Printer Handbook*
Jeff Prosise is a contributing editor and the author of the *PC Magazine Guide to DOS 5 Memory Management.*
Sal Ricciardi is a contributing editor and the author of the forthcoming *Running FoxPro* books from Microsoft Press.
Neil J. Rubenking is technical editor and the author of two Turbo Pascal books and *PC Magazine DOS Batch File Lab Notes.*
Joe Salemi is a contributing editor and the author of the *PC Magazine Guide to Client/Server Databases.*
Luisa Simone is a contributing editor and the author of the book *Microsoft Publisher*
Craig Stinson is a contributing editor and coauthor of *Running Windows 3.1* and *Running Microsoft Excel*
M. David Stone is a contributing editor and coauthor of *Word for Windows Companion,* Second Edition.
Ethan Winer is a contributing editor and the author of *PC Magazine BASIC Techniques and Utilities*

▶**PC MAGAZINE:** It's not unusual for notebook batteries to discharge after a week or two, especially when a portion of memory is maintained as a RAM disk. Whether or not you can leave the computer plugged into its power supply depends on the charger used in the system.

A trickle charge sends a continuous current, even after the battery has reached a capacity charge. This can shorten the life of the battery, so don't leave this type of charger attached indefinitely if you want to maximize battery life. A float charger reduces the current as the battery reaches capacity, and so avoids damage to the battery. Your computer's documentation should state which kind of charger is used.

You also need to consider a nickel cadmium battery's "memory"; if you recharge the battery before it has been fully discharged, it will "remember" the level it was at when you recharged it and will only discharge to that point (that is, it will effectively go dead at that point).

Manufacturers are now including complete discharge cycles as part of their battery power management features, but if your computer doesn't have this feature, simply run the battery as far down as possible before you recharge it; there are also utilities available that include deep discharge routines to make this easier. You can also recover the capacity lost to the memory effect by running the battery through a series of complete discharge and charge cycles.

One of the most convenient solutions is to purchase an extra battery pack and an external charger if they're available for your computer. This lets you keep a fully charged battery in reserve, so you

INDEX

PCs
Windows without disks 344
Keeping batteries charged 344
Operating Environments
Windows swap file 345
Clearing hidden and system attributes 345
Word Processing
A formatting shortcut for Word and WinWord 347
Spreadsheets
Using functions in Excel chart series formulas 347
Databases
BOM and EOM in Paradox 349
A PROPER() for dBASE 351
Graphics
DTP goes international 351
The right direction 354
Networking
Moving to unshielded twisted-pair wiring 354
Modem connections to PBX phones 363
Languages
Accessing video memory 363
Vertical Applications
Hotel/Motel management software ... 378

can keep working even after you deplete the battery in your notebook.
—*Alfred Poor*

Operating Environments

WINDOWS SWAP FILE

❓ While working on a friend's computer, I found a hidden file in the root directory with the name 386SPART.PAR—and it was 5MB in size! I've never seen a hidden file this large. It contains some program code and ASCII text that lists various parts of programs from his system. I know how to delete the file, but I'd like to know how it got there before I do.

Tim McLaughlin
Van Nuys, California

▶**PC MAGAZINE:** This isn't an uncommon discovery for Windows users who go poking around on their hard disks. What you discovered is a permanent Windows swap file that is used as virtual memory in 386 Enhanced mode. It looks like memory to Windows, but it's actually disk storage. The net effect is that Windows can move idle programs and data to virtual (on-disk) memory, so working programs can use the faster RAM.

Windows 3.0 doesn't automatically set up a permanent swap file, but Windows 3.1's SETUP program will—if it can. To create a swap file in Windows 3.0 you had to run a separate utility, but in Version 3.1 this function is available through the 386 Enhanced icon on the Control Panel. The swap file is created in the root directory of any drive you specify, and can be as large as the largest contiguous (that is, not fragmented) section of disk space that's available.

If you're installing Windows on a new system, it's easiest to set up the swap file when you're configuring it—before the disk is filled or before it becomes fragmented. If you're working on an existing system, you should defragment your disk before creating a swap file. When you create a permanent swap file, Windows also adds a hidden, read-only file named SPART.PAR to your Windows directory.

If you don't create a permanent swap file, a temporary one will be created every time you run Windows. It will be named WIN386.SWP and will vary in size depending on the amount of available hard disk space. When you exit Windows, this temporary file will be deleted. In general, Windows will start and shut down faster if you use a permanent swap file, since it won't have to create the file on startup and then erase it when you exit.

One important advantage of a permanent swap file that is often overlooked is data recovery. If you're working with Windows in 386 Enhanced mode and encounter a fatal crash (which fortunately seems to be less frequent under Windows 3.1 than 3.0, but still happens enough to notice) and an application closes before you've had a chance to save it, there is a chance that you may be able to recover the data from the swap file.

Use any editor or file viewer that can handle binary files (the Viewer in PC Tools works well since it can find hidden files) to examine the contents of your swap file. If your viewing program has the feature, search on any word that appears in the data you want to recover—when you're searching through a file that is many megabytes long, this can be an important time-saver. Most file editors will also allow you to cut and save portions of the file that you want to recover.
— *Alfred Poor*

HOW TO CONTACT US

Do you have a hardware, software, or systems problem you can't solve? Do you have a tip you think other readers could use? Or maybe you'd like a better understanding of how something works. If so, we invite you to let us know about it. Our experts can give you practical solutions to your problems, provide techniques for using your software and hardware more productively, and help you grasp computer concepts and understand the latest technology.

It's easy to contact us. Just send us your submission (use ASCII format for text files) via the medium that's most convenient for you:

U.S. Mail: Solutions, *PC Magazine*, One Park Ave., New York, NY 10016-5802. (Please send a floppy disk along with a printout.)
Fax: 212-503-5799
MCI Mail: Solutions, 556-3896
CompuServe Mail: 72241,104
PC MagNet: Select Submissions to PC Magazine from the main PC MagNet menu. Upload your file to the most appropriate library. If at any time you need help, simply type a question mark (?) and hit Enter; a list of commands will be displayed. If you are not already a member of PC MagNet but would like to join, follow the instructions on page 12 to find your local access number.
CompuServe Members: If you're a CompuServe member, you can join PC MagNet by typing GO PCMAG at any CIS prompt.

For any tip we print, you'll receive $50 plus a *PC Magazine* T-shirt. We regret that we cannot answer letters individually.

CLEARING HIDDEN AND SYSTEM ATTRIBUTES

❓ While cleaning up my hard disk, I found a file called MIRORSAV.FIL that had been put in the root directory by the DOS MIRROR command. I wanted to delete it but several commercial utilities failed, so I tried DOS's own ATTRIB command—with the same result. How can this or a similar file be erased without a drastic step such as WIPEDISK or FORMAT?

Wm. G. Powell
Dallas, Texas

▶**PC MAGAZINE:** You can't delete a file marked with any attribute such as read-only, hidden, or system, much less one with all three—MIRORSAV.FIL, for example. Fortunately, the release of DOS you're running also provides the solution to your problem. (I can tell you're using DOS 5.0 since MIRROR wasn't part of

Hot Stuff for '93

6 EDITORS' CHOICE AWARDS!

486-33MHz Localbus

An exceptional Windows performer with 32-bit VESA localbus graphics accelerator for exceptional video!

- Intel i486SX-33 microprocessor
- 4MB RAM
- 64K SRAM memory cache
- 170MB 15ms fast IDE hard disk
- 1.44MB floppy drive
- 32-bit VESA localbus graphics accelerator & 14" color monitor

$1,495

486-66MHz Burner

More processing power for your computing dollar. Without question, the industry's best 66MHz value!

- Intel i486DX2-66 microprocessor
- 4MB RAM
- 64K SRAM memory cache
- 170MB 15ms fast IDE hard disk
- 1.44MB floppy drive
- 32-bit VESA localbus graphics accelerator & 14" color monitor

$1,995

EISA LocalBus Blowout

The power of EISA *plus* lightning-fast Localbus graphics for under $2,000!

- Intel i486SX-33 microprocessor
- 4MB RAM
- 64K SRAM memory cache
- 170MB 15ms fast IDE hard drive
- 32-bit EISA caching controller
- 1.44MB floppy drive
- 32-bit VESA localbus graphics accelerator & 14" color monitor

$1,895

EISA POWERHOUSE

The most-awarded 486 EISA power platform - with a new 45 Winmark 32-bit graphics accelerator for '93!

- Intel i486DX2-66 microprocessor
- 8MB RAM with 256K cache
- 200MB 15ms fast SCSI hard disk
- 32-bit EISA caching controller
- 1.44MB floppy drive
- 45 *Winmark* 32-bit graphics accelerator & 14" color monitor

$3,295

100MHz 64-Bit

Ready-to-run Windows NT, UNIX and UnixWare - 2X faster than a 486-66! A software developer's dream machine!

- 100MHz 64-bit microprocessor
- 16MB RAM (up to 256MB)
- 200MB 15ms fast SCSI hard disk
- Localbus SCSI, Ethernet & audio
- four 32-bit EISA slots
- 1.44MB floppy drive
- Internal CD-ROM drive
- 64bit localbus 1280x1024 graphics controller & 14" monitor

$9,995

66MHz Disk Array

Our 1993 MultiServers double the performance at half the cost! Custom server solutions for NetWare, UNIX, DOS/Windows, OS/2 or NT. Ask about our new VAR program.

- One to ten 486-66 processors!
- 16MB to 256Mb RAM
- 400MB to over 400GB storage
- Industry-leading 17.5MB/s of *continuous* DTR
- 1-3ms *continuous* access time
- Multi-buffered disk I/O
- Ethernet or 100Mb twisted pair

***servers from* $5,000**

Get Your Money's Worth!

Tangent's *all-new* 1993 models offer more value, performance and customer support for your computer system or network investment than anyone else. With Tangent you order directly from SCO, Novell, Windows and OS/2 certified engineers that can set you up with complete networks supporting up to 1,000 nodes! And, if you're looking for the best workstations the industry has to offer, we've got them too!

Call Tangent for A Winning Deal Today!

Talk to one of our experts and see for yourself why you just won't lose with Tangent. The best products. The best performance. *Your best choice.*

800-800-6060

TANGENT COMPUTER

CORPORATE PURCHASE ORDERS WELCOME • GSA# GS00k91AGS5212

197 Airport Boulevard, Burlingame, CA 94010
415/342-9388 • FAX 415/342-9380

All models available with a full range of CPU, memory and disk options. All specifications and prices subject to change without notice.
© Copyright 1992 Tangent Computer Corporation. TCS 1/93PCMB All trademarks are owned by their respective companies. Intel is a registered trademark of Intel Corporation.

CIRCLE 045 ON READER SERVICE CARD.

earlier versions.) Prior to version 5.0 of the operating system, ATTRIB could remove the read-only attribute, but not the other two. With DOS 5.0, ATTRIB gained control of the hidden and system attributes.

ATTRIB didn't work because you can't change the attributes of a hidden file without explicitly setting or clearing the hidden attribute at the same time. The same holds true for the system attribute. You probably tried one of two commands: `ATTRIB -H MIRORSAV.FIL`, which fails because the file has the system attribute set, or `ATTRIB -S MIRORSAV.FIL`, which fails because the file is also hidden. The only way to remove the hidden and system attributes is to handle both at once. The command `ATTRIB -R -H -S MIRORSAV.FIL` will remove all three of the attributes that prevent you from deleting that file.

If you're going to delete MIRORSAV.FIL, you'll also want to erase the much larger read-only files MIRROR.FIL and MIRROR.BAK. These contain a copy of the root directory and File Allocation Table of the disk, so their size varies with the size and format of the disk. Note that the purpose of these files is to make it possible for the UNFORMAT command to restore your hard disk if it's ever formatted accidentally. Run MIRROR every day and you can recover almost 100 percent after an inadvertent FORMAT, but only if you're willing to dedicate disk space to the files MIRROR produces.—*Neil J. Rubenking*

Word Processing

A FORMATTING SHORTCUT FOR WORD AND WINWORD

TIP Microsoft Word's styles provide an easy way to give a paragraph a previously defined format that may contain such things as a special indentation or a complicated set of tabs. But if you don't use style sheets or simply don't want to create a style in a particular situation, there's another easy way to reformat a paragraph to match the format of a previous paragraph.

First make sure that Word's Show Non-Printing Symbols option is set to Partial or All. (To set the option, choose Options from the Word menu.) This will let you see the paragraph markers at the end of each paragraph. Then move the cursor to the paragraph marker at the end of the paragraph you want to copy the format from, and give the command to copy to scrap (Alt-F3, or Escape Copy Enter, or Del then Ins to cut the selection and to immediately reinsert it while leaving a copy in scrap).

Next, go to the location you want to copy the format to, and place the cursor on the paragraph marker for that paragraph—at the end of the text if you've already written the paragraph, or on the lone marker on the otherwise blank line. (If necessary, hit Enter to create a blank line first.) Then press Insert to copy the original marker, with paragraph formatting, to this second paragraph.

The same approach works for margin settings or other division-level formatting. Place the cursor on the double dotted line at the end of a division, copy the marker to scrap, move to the spot where you want to insert a division marker with the same settings, and hit Ins.

Annelyse Etienne
Luxembourg

PC MAGAZINE This technique works because Word 5.0 stores its paragraph- and division-level formatting information along with the markers for each level rather than using separate formatting codes. As a result, when you cut, copy, or move one of the markers, the formatting goes along with it.

You'll find the same underlying design in Word 5.5 and in Word for Windows, which means you can use this same technique in those programs too. The details differ, however. In particular, 5.5 and WinWord use a different terminology, with *sections* instead of *divisions*, and they use different commands for copying and inserting.

Word 5.5 users can use the Preferences dialog box to set the paragraph markers so they will show. To open it, choose Utilities | Customize | Preferences. WinWord 2.0 users will find the setting in the Options dialog box by choosing Tools | Options | View. In both of these programs, make sure that there is a check in either the All check box (Show All in Word 5.5) or in the Paragraph Marks check box. Alternatively, WinWord 2.0 users can show all of the markers simply by clicking on the Show All toolbar button, which looks like a paragraph mark at the far right of the toolbar.

In both Word 5.5 and WinWord you'll have to select the marker with keyboard or mouse before you can copy it to scrap (or to the Clipboard in WinWord). But Word 5.5 users can use the Shift-Del shortcut to copy to scrap without selecting text first. To insert the marker in either program, use that program's usual insert commands. —*M. David Stone*

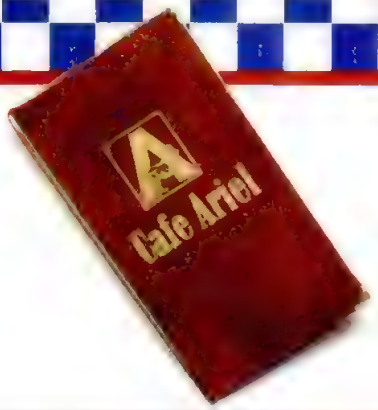
Spreadsheets

USING FUNCTIONS IN EXCEL CHART SERIES FORMULAS

TIP In Excel, I often need to create charts that plot only the most recent 13 weeks of various data ranges. Since Excel provides no easy way to edit chart series, I've accomplished this by creating range names based on Excel's Index function. As time passes and new numbers are added to my database, the ranges pointed to by my names automatically adjust to select only the most recent 13 weeks' worth of data.

For example, in one Excel database, I have the field headings WW, Volume, and Yield. Each record in this database represents one work week (WW). To create a chart that always shows the most recent 13 weeks, I used the Formula | Define Name command to create the names Lookback, WW, Vol, and Yield, as follows:

```
Lookback =12
WW =INDEX(Database,ROWS(Database)
-Lookback,1):INDEX(Database,ROWS
(Database),1)
Vol =INDEX(Database,ROWS(Database)
-Lookback,2):INDEX(Database,
ROWS(Database),2)
Yield =INDEX(Database,ROWS(Database)
-Lookback,3):INDEX(Database,
ROWS(Database),3)
```



A PC Menu For High Tech Appetites.

SPECIALTIES OF THE HOUSE

Windows Power Stations

486SX-25D* $1545
486SX-33D* $1695
486DX2-66D* $2245

Micronics Motherboard
256k Cache on 486SX-33; and 486DX2-66
Desktop, 200 Watt PS
4 Meg 70ns RAM
1.2 or 1.44Mb TEAC FDD
120 Mb IDE Hard Drive
Volante™ Warp10 S3801
ViewSonic 4E Color 14" VGA
MS Mouse,2-S Ports, 1-P Port
Keytronics 101 Keyboard
MS DOS, MS Windows 3.1
Choice of Borland Software
OverDrive™ Ready ZIF Slot

486SX-33VLB* $1995
486DX-33VLB* $2295
486DX2-66VLB* $2695

Micronics VL-Bus, 256k Cache
6 Bay Tower; 250 Watt PS
4 Meg 70ns RAM
1.2 and 1.44 MB TEAC FDD
213 Mb Maxtor IDE Hard Drive
Two 32-Bit VL-Bus Slots
Volante™ Warp10LB S3805
ViewSonic 6E NI 14" Color VGA
MS Mouse, 2-S Ports, 1-P Port
Keytronics 101 Key Keyboard
MS DOS, MS Windows 3.1
Choice of Borland Software
OverDrive™ Ready

486DX2-66VLS* $4795
486DX2-66EVS* $4995

VLS Micronics VL-Bus 256k Cache
EVS AMI EISA/VL-Bus 256k Cache
8 Bay Tower Case, 300 Watt PS
8 Meg 70ns RAM
1.2 and 1.44 MB TEAC FDD
877 Mb Toshiba SCSI Hard Drive
UltraStor 34F VL-Bus SCSI Contrl.
ATI Ultra Pro VL-Bus Graphics Card with 1Meg VRAM
NEC 84JD CD ROM
ViewSonic 6FS 15 NI Color VGA
MS Mouse, 2-S Ports, 1-P Port
Keytronics 101 Keyboard
MS DOS, MS Windows 3.1
Choice of Borland Software
PENTIUM™ upgradable

Systems

EISA/VL-BUS DX2-66 SYSTEMS Two of the 8 EISA slots are also VL-Bus slots, Systems support PENTIUM™ upgrades.
EISA DX-50 SYSTEMS With 8 EISA slots and 512k cache.

Hardware

SCSI CONTROLLERS Choose the UltraStor 34F VESA/SCSI Controller, or an American Megatrends EISA SCSI caching controller.
CD ROMS The NEC CDR84JD CD ROM with Pro Audio Spectrum 16.
MONITORS ViewSonic 6E, 6FS, 7 and 8; and the NEC 4FGx, 5FGx, 6FGx.
HARD DRIVES IDE drives up to 520MB and SCSI up to 2.8 gigabytes.
GRAPHICS CARDS Choose from the S3 801 and 805 Volante Warp10, the ATI Ultra Pro VL-Bus, and a new Weitek 9000 based graphics cards.

Software

BORLAND SOFTWARE With each Windows Power Station you may choose : Quattro® Pro for Windows; Borland® C++® for Windows/ DOS; or Paradox® for Windows.
IBM OS/2 2.0 Ariel will help you configure your operating system.
WINDOWS FOR WORKGROUPS The $150 option includes an Ethernet card and the softwawre installed.

OS/2 Work Station

486DX-50ES* $3995
486DX2-66ES* $4095

Micronics EISA, 512k Cache
8 Bay Tower Case, 300 Watt PS
8 Meg 70ns RAM
1.2 and 1.44 MB TEAC FDD
877 Mb Toshiba SCSI Hard Drive
2-S Ports, 1-P Port
AMI EISA/SCSI Controller
Volante™ Warp10 S3801
ViewSonic 6E NI Color VGA
MS DOS, MS Mouse
Keytronics 101 Keyboard
IBM OS/2 2.0
PENTIUM™ upgradable

*Contain Intel 486 ™ microprocessor

Your computer company shouldn't remind you of a fast food restaurant. A menu with little choice, and ingredients that are bland at best. A place were you'd never ask for a special order, because it's an endless wait if it's not pre-packaged. It may be the standard fare, but what are you settling for?

Think of Ariel as your favorite cafe where the selections are fresh with the latest technology. Where a knowledgeable staff serves award winning systems and indulges your tastes.

PC MAGAZINE EDITORS' CHOICE
The Ariel 486SX/25
October 13, 1992

Ariel Design, Inc.
COMPUTER SOLUTIONS

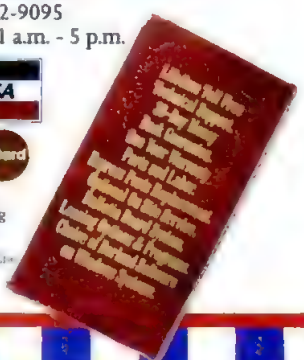
800-952-7435

145 Webster Street Hanover MA 02339
617/982-8800 FAX: 617/982-9095
Mon - Fri 9 a.m. - 8 p.m. Sat 11 a.m. - 5 p.m.

* intel inside

VISA MasterCard

Prices and specifications are subject to change without notice. Prices do not include shipping The Intel Inside Logo is a trademark of Intel Corporation. IBM and OS/2 are registered trademarks of the International Business Machines Corp. Other brands and product names are trademarks or registered trademarks of their respective companies



CIRCLE 209 ON READER SERVICE CARD

Then I edited the SERIES formulas in Excel's chart window to substitute the names WW, Vol, and Yield for the explicit range references that Excel used when I first created the chart. Now, whenever I add new data, I use the Data | Form command. This automatically expands the database to include new information, and the INDEX functions automatically pick the last 13 records. If I decide to change the historical length of my chart (say, to chart the most recent 26 records), all I need to do is change the definition of Lookback.

Wyatt Huddleston
Austin, Texas

▶PC MAGAZINE: This is an elegant solution to a common problem. Excel's SERIES formulas—the formulas used to define each data series in your charts—do not accept arguments based directly on the INDEX function. But they do accept names, and names in Excel can be assigned to any kind of expression, not merely to cell or range references. Thus, as Mr. Huddleston discovered, the way to plug an INDEX expression into a SERIES formula is to assign the expression to a name, and then use the name in the SERIES formula.

The INDEX function, whose syntax is

```
=INDEX(reference,row_number,
 column_number,area_number)
```

returns a reference to an element within a range. For example, the formula

```
=INDEX(Database,3,4)
```

would return the value of the cell in the third row of the fourth column within the range named Database. (The fourth argument, *area_number*, is used only when the first argument is a "multiple selection"—that is, a discontiguous range.) The expression

```
INDEX(Database,ROWS(Database),1)
```

returns the value of the cell at the bottom of the first column of the range named Database, and the expression

```
INDEX(Database,ROWS(Database)
-Lookback,1)
```

returns the value of the cell 12 rows up from the bottom of the first column (because the name Lookback has been assigned to the value 12). Thus the formula that Mr. Huddleston assigned to the name WW:

```
INDEX(Database,ROWS(Database)
-Lookback,1):INDEX(Databas e,ROWS
(Database),1)
```

returns a range within the first column of his database, extending from the cell 12 rows up from the bottom to the bottom cell. The formulas assigned to the names Vol and Yield return similar ranges in the second and third columns, respectively.

Unfortunately, although Excel's graph module is generous about accepting names in SERIES formulas, it provides no services to help you do that. The Paste Name, Apply Name, Find, and Replace commands are all unavailable in chart windows. Therefore, you have to apply the names by hand. You can do this with the Edit Series command (on the Chart menu), but this approach forces you to edit a long formula within a narrow dialog box edit field.

You'll probably find it easier to start by clicking on the chart series whose formula you want to edit. Excel will respond by displaying the SERIES formula on the edit line at the top of the window. There you can see the entire formula at once while you make your changes.

As Mr. Huddleston points out, you can use his technique to make your charts plot the most recent *n* data points in a series, just by changing the value of Lookback to *n*-1. You can also use his technique to build a graph that plots all data in a range but automatically adjusts to include any new data points you add. In this case, the INDEX expression at the left of the colon in your range name definitions would not need to reference a Lookback value. Instead, it would probably look like this:

```
Name=INDEX(Database,2,1):INDEX
(Database,ROWS(Database),1)
```

You would use the value 2 as the row-number argument in the first INDEX expression because the first row of your database would consist of field-name headings.

One final tip: Creating range names of the sort used by Mr. Huddleston involves a good deal of typing. But if you're creating a set of names that are identical except for the column-number arguments, you only have to type the long formula once. After you've created your first name in the Formula Define Name dialog box, click Add, not OK. Then you can create subsequent names just by editing the first one.—*Craig Stinson*

Databases

BOM AND EOM IN PARADOX

TIP I found John Kaster's BOM() and EOM() techniques [see Databases, June 16, 1992] very interesting. Since I often use Paradox, I converted his routines from Clipper into the PAL procedures shown in Figure 1. I have also supplied a short test script you can use to demonstrate the functions.

Larry Siemiaszko
Freehold, New Jersey

Bom() and Eom() for Paradox

```
;Returns the first of the month
PROC Bom(dDay)
 IF dDay = BLANKDATE() THEN
   dDay = TODAY()
 ENDIF
 RETURN dDay - DAY(dDay) +1
ENDPROC

;Returns the last of the month
PROC Eom(dDay)
 PRIVATE dBump
 IF dDay = BLANKDATE() THEN
   dDay = TODAY()
 ENDIF
 dBump = dDay + 35 - Day(dDay)
 RETURN dBump - Day(dBump)
ENDPROC

;The following script demonstrates
;the above procedures
CLEAR
MESSAGE
 "The first of this month is "
 + STRVAL(Bom(TODAY()))
SLEEP 2000
CLEAR
SLEEP 500
MESSAGE
 "The last of this month is "
 + STRVAL(Eom(BLANKDATE()))
SLEEP 2000
```

Figure 1: Two Paradox procedures that determine the first and last date of the month based on a date parameter, and a script that demonstrates them.

WINDOWS keydata

Combining Quality with Affordability

... the way you want it!

Keydata offers a full range of computers...

for applications ranging from everyday number crunching and word processing, to our EISA-based PowerStations for heavy CAD/CAM and server use.

Which ever system you choose, you get the performance assurance of stable, fully proven motherboards built by one of the world's foremost motherboard manufacturers.

486-33 VL-Bus WindowStation

$2345.
LEASE $87/MO.

- Intel 486™-33 MHz processor with built-in 8K cache & 487 coprocessor
- 8MB RAM, 256K cache on board
- 210MB high-speed hard disk drive
- Two 32-bit VESA local bus slots
- ZIF socket on board
- 15" VESA non-interlaced SVGA programmable monitor

486-50 VL-Bus WindowStation

$2495.
LEASE $92/MO.

- Intel 486™-50 MHz processor with built-in 8K cache & 487 coprocessor
- 8MB RAM, 256K cache on board
- 210MB high-speed hard disk drive
- Two 32-bit VESA local bus slots
- ZIF socket on board
- 15" VESA non-interlaced SVGA programmable monitor

486DX2-66 VL-Bus WindowStation

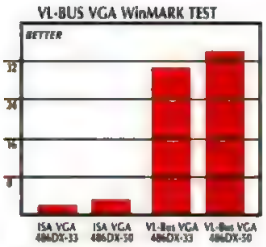
$2645.
LEASE $98/MO.

- Intel 486DX2® 66 MHz processor with built-in 8K cache & 487 coprocessor
- 8MB RAM, 256K cache on board
- 210MB high-speed hard disk drive
- Two 32-bit VESA local bus slots
- ZIF socket on board
- 15" VESA non-interlaced SVGA programmable monitor

intel inside

WINDOWS... WITHOUT THE WAIT!

For Windows performance that's up to 15 times faster than on standard ISA machines, Keydata 486 WindowStations use the VESA local bus -- and our accelerated WINdirect VL-bus video card.



ISA is based on Trident 8900C
VL-Bus VGA based on WINdirect graphics accelerator

CHOOSE YOUR BONUS SOFTWARE!

Tell your Keydata sales consultant which complementary package you want: Norton Desktop, PFS: Windows Works, GeoWorks Pro, Quattro* Pro, Paradox*, dBase IV*, ObjectVision, Turbo C++, Turbo Pascal or Sidekick.

* Available only with orders totaling $2500 or more.

PICK ONE ---FREE!

PC MAGAZINE
January 26, 1993
"The 486DX2-66 KeyStation EISA tower has been designed with expandability in mind. Its growth potential is bolstered by its above-average processor, memory and Disk Winmark scores."

INFO WORLD
October 1992
In a head-to-head test of a dozen leading 486 machines, "the Keydata 486/33 WindowStation posted the highest SYSmark 92 rate" was singled out for Keydata's "first-rate support policies," and was awarded the Infoworld "Buyers Assurance Seal".

PC Sources
August 1992
"The Keydata 486/33 WindowStation offers a lot of computing for its price ... If you really want to exploit Windows, a system like this one is a really good place to start."

COMPUTER SHOPPER
November 1992
"Keydata's 486/33 WindowStation contained perhaps the best combination of parts, price, performance and service." and was selected for "The Winners Circle".

keydata

EXEMPLARY CUSTOMER SUPPORT:

18-MONTH WARRANTY WITH EXPRESS PARTS REPLACEMENT POLICY
Replacement parts are sent free, via UPS 2nd Day Service. (Notebook models with 1-year limited warranty)

18 MONTH

NO CHARGE UNTIL SHIPMENT
Your credit card isn't charged until the day your order is shipped.

1-YEAR ON-SITE SERVICE
Your purchase of a Keydata system initiates one year of on-site service. (Does not apply to notebook models)

LIFETIME TOLL-FREE TECHNICAL SUPPORT
Call our Tech Support Line: 1-800-486-9100

PRE-INSTALLED PROGRAMS AND FULL DOCUMENTATION
Your system arrives with MS DOS 5.0 and Windows 3.1 already installed.

30-DAY MONEY-BACK GUARANTEE
Return your system within 30 days if you're not satisfied. You'll receive a full refund on the hardware price -- with no restocking charge. (Notebook models must be returned in perfect condition to qualify. Otherwise, 7% restocking fee may apply.)

TERMS:
No surcharge for VISA, MasterCard, American Express and Discover. Please allow 10 days for personal and company checks to clear. C.O.D. with cash or money order only. We accept government, educational and corporate Purchase Orders. Dealer and VAR inquiries welcome
RETURN POLICY: RMA number required for all returns. All return items must include original package and accessories

CIRCLE 007 ON READER SERVICE CARD

CALL NOW TOLL-FREE:

1-800-486-7010

Business Hours: Mon - Fri 9:00 am to 8:00 pm EST
Sat 10:00 am to 4:00 pm EST
Custom Configurations Available
Corporate Orders Please Call 1-800-486-4800

VISA

Keydata International Inc.
111 Corporate Blvd. South Plainfield, NJ 07080
Tel: 908-755-0350 • Fax: 908-756-7359

▶PC MAGAZINE: A lot of readers found Kaster's routines fast and useful. The routines shown in Figure 1 comprise a very straightforward port of the originals to Paradox's PAL language. In PAL, you use the BLANKDATE() function to determine whether a date is empty, whereas this is done with a comparison to NIL in Clipper. And the PAL function that returns the current date is called TODAY(); in Clipper the function is called DATE().

Download BOMEOM.SC from the Utilities/Tips Forum on PC MagNet.
—Sal Ricciardi

A PROPER() FOR DBASE

TIP If you've ever had to print mailing labels in all-uppercase letters because that's how the names and addresses are stored in the database, the following program is for you. The program, called CAPFIRST, accepts a string from dBASE (dBASE III Plus and dBASE IV) and capitalizes the first character of each substring within the string, while converting the remaining characters to lowercase. (In this context a substring is a group of characters separated from another group of characters by any number of spaces or tabs.)

You can create CAPFIRST by creating the script file shown in Figure 2 and redirecting it to DEBUG by entering the following:

```
DEBUG < CAPFIRST.SCR
```

Consider the following example:

```
.cName = "JOHN j. JONES"
.LOAD CAPFIRST
.CALL CAPFIRST WITH cName
.RELEASE MODULE CAPFIRST
.? cName
John J. Jones
```

After CAPFIRST has been run, the variable cName contains "John J. Jones" instead of "JOHN j. JONES".

Roger W. Sauer
Fairfield, California

▶PC MAGAZINE: This capability is provided by the PROPER() function in other Xbase dialects such as Arago and FoxPro. But dBASE IV 1.5 has no equivalent function. If you're working with a database of uppercase names downloaded from a mainframe, this may help provide that first step at converting those names into proper format.

When typing in the DEBUG script in Figure 2, be sure to enter the blank line after the line containing RETF. Alternatively, the CAPFIRST.DBG DEBUG script as well as the CAPFIRST.BIN file can be found in CAPFIR.ZIP in the Utilities/Tips Forum on PC MagNet.
—Sal Ricciardi

CAPFIRST.SCR
Complete Listing

```
N CAPFIRST.BIN
A 100
MOV CX,BX
MOV AL,[BX]
CMP AL,0
JE  132
CMP AL,20
JE  110
CMP AL,9
JNE 113
INC BX
JMP 100
CMP BX,CX
JE  123
CMP AL,41
JB  12F
CMP AL,5A
JA  12F
OR  AL,20
JMP 12D
CMP AL,61
JB  12F
CMP AL,7A
JA  12F
AND AL,5F
MOV [BX],AL
INC BX
JMP 102
RETF

R CX
33
W
Q
```

Figure 2: **This DEBUG script creates CAPFIRST.BIN, which you can use with LOAD in dBASE IV to emulate the PROPER() function found in other dialects.**

Graphics

DTP GOES INTERNATIONAL

? I live in Beirut, Lebanon, and do a lot of desktop publishing in Armenian. Out of necessity I've developed bitmapped Armenian fonts for the HP LaserJet II using ZSoft's Publisher's Type Foundry. I'd like to create scalable fonts for both TrueType and PostScript. Do such programs exist? What about one that can accurately convert my bitmapped fonts?

H. Milikian
Beirut, Lebanon

▶PC MAGAZINE: You're in luck. You'll find viable options for both TrueType and PostScript due to increasing interest in scalable fonts.

Before addressing your question, though, I should clarify some terminology and a few related items: PostScript actually refers to Adobe's page description language (PDL) and requires a PostScript-compatible printer for final output. The phrase *Type 1 fonts* refers to Adobe's font technology. Type 1 was originally developed as PostScript's native font format. Thanks to utility programs such as Adobe Type Manager and Bitstream Facelift, though, Type 1 fonts are increasingly independent of the PostScript PDL, allowing you—in many cases—to use them with non-PostScript printers. Now, on to your concerns.

For aesthetic reasons you may want to develop your own typefaces, in which case you should consider Fontographer for Windows, Version 3.5 (Altsys Corp., Richardson, Texas, 214-680-2060). This $495 program recently migrated to Windows from the Mac, where it has enjoyed great popularity since 1986. The software lets you create scalable, *hinted* fonts in either Adobe Type 1 or TrueType formats.

Hinting is an essential feature for a typeface design program. Ultimately an outline font must be *rasterized* (converted to a bitmap) in order to be displayed on-screen or output to a printer. Hinting provides invaluable clues that allow letterforms to be accurately reproduced at small point sizes on low-resolution devices, such as your 72-dpi computer screen or 300-dpi laser printer.

Fontographer makes a good choice for several reasons. Should you decide to create fonts, you'll get a great deal of control over their attributes: stroke weights, character widths, and kerning pairs, for instance. And it can also help you to leverage the investment you've already made in custom PCL (Hewlett-Packard LaserJet) fonts. There is no totally auto-

EPS Gives You VESA Local Bus And An Unbeatable

In 1990, '91 and '92, people like yourself voted to honor the EPS 486 33 MHz with the Readers Choice Award and here's why. We've proven that EPS offers a quality computer at a great price and that's only the beginning.

EPS offers customers several crucial elements that others don't. Take for example our 15" digital monitor with its flat screen and non-glare tube. It's available with all our systems. The digital monitor offers push button controls which are more accurate than thumb-wheel units. They give you horizontal and vertical sizing adjustment which eliminates pin-cushioning or barrel effects, plus allow huge blow-ups of on-screen images with entire-screen positioning.

CM CM CM
486-33 System 486-33 System 486-33 System

We also offer 256K cache. There are companies who will tell you that anything over 64K is a waste. To them we say, "NOT." The larger the cache the greater the hit ratio, which means your desired data will be provided without delay, thus causing higher performance. In addition, the larger the cache the more locations there are to store data. With 256K cache you have a 90% greater hit ratio.

Our VESA Local Bus Is Hot!

The industry is buzzin' with VESA local bus and EPS offers the hottest performance on the market. We guarantee you'll be blown away by its incredible speed. We're talking performance! Our first EPS local bus slot is accompanied by our 'warp speed', local bus card, allowing you to achieve ***40 million plus winmarks*** (when tested with our EPS 66MHz), 16 million colors, 1 MB of VRAM or 2 MB VRAM for 1280 x 1024 non-interlaced with 256 colors, making it ideal for Windows applications. In fact, it gives you the highest local bus graphics capabilities in the industry. That's something everybody's buzzin' about.

Our second VESA local bus slot offers our high-speed local bus IDE controller, which gives you

EPS ISA & EISA Systems

EPS 486 ISA & EISA Models Standard With:

- INTEL 486 Processor, 256K Cache On Board (Your Option: 486-SX 25MHz, 33MHz, DX2-50MHz, DX2-66MHz DX2 50MHz EISA & DX2 66MHz EISA)
- 4 MB High Speed RAM
- Both TEAC 1.2 MB & 1.44 MB Floppy Disk Drives
- Maxtor 130 MB IDE HD (15ms)
- Orchid Fahrenheit 1280 VA Voice Annotation 1 MB SVGA Card. With Exclusive *Voice Notes* Software
- EPS 14" 1024 x 768 Non-Interlaced SVGA Monitor .28 Dot Pitch
- 101 Enhanced Keyboard
- Baby Desktop Case w/6 Drive Bays
- MS WINDOWS 3.1
- MS DOS 5.0
- 3-Button 1600 DPI Mouse
- System User Manual
- 60-Day Money-Back Guarantee
- 3-Year Superior Warranty
- 1-Year On-Site Service, Extension Available
- Customizing Available

Popular Options

An Additional 4 MB Of Ram	$140.00
245 MB Maxtor Hard Drive	99.00
15" Digital EPS Monitor With Push Button Ease	125.00
Vertical Case w/250 Watt P/S & 2 Cooling Fans	75.00
250 MB Tape Back Up w/Tape	195.00
EPS 14.4 Fax/Modem	195.00

Many, Many More Options Are Available. Call Your EPS Sales Consultant Now:

486-SX 25MHz Standard 0 Cache w/ overdrive CPU Socket

Now Available: the Orchid 1280 VA, Voice Annotation Card – This Windows accelerator has a HyperDriver that delivers the fastest Windows available.
**If the Orchid Voice Annotation card is too much for you, we have our 16.7 million color 1 MB 24 bit SVGA card (w/accelerated Windows drivers)*
Note prices below.

486-SX 25MHz
$1495
***$1425**

486-DX2 66MHz
$2095
***$2025**

486-33MHz
$1775
***$1695**

486-DX2 50MHz EISA
$2245
***$2175**

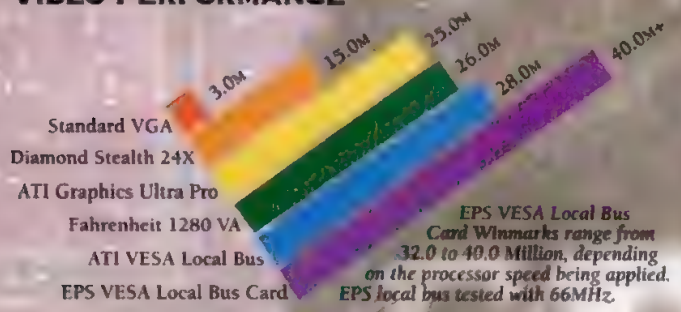
486-DX2 50MHz
$1945
***$1875**

486-DX2 66MHz EISA
$2395
***$2325**

WITH POWER, PERFORMANCE
3-YEAR WARRANTY

a ***70% faster throughput*** over conventional ISA IDE. Like we said, it's hot! For those of you that

VIDEO PERFORMANCE



demand the ultimate in caching controllers, we offer the option of 512K to 16 MB of on board disk cache – giving you a dynamic 10 MB of data throughput!

The folks at PC World were so impressed with our 486 33MHz that they gave us their Best Buy Award.

If that's not enough to sell you, in December of '89 we were the first to offer a 60-day money-back guarantee, and now we're setting the pace by being the first to offer our superior 3-year warranty. It's no wonder intelligent people like yourself have made the choice to buy EPS.

Call your sales consultant today.

PC WORLD BEST BUY
486 33 MHz SYSTEM

VESA LOCAL BUS SYSTEMS

486-33MHz $1995
486-50MHz DX2 $2145
486-66MHz DX2 $2295

STANDARD CONFIGURATION

- INTEL 486 Processor, 256K Cache On Board (Your Option: 33MHz, DX2-50MHz & DX2-66MHz)
- 4 MB High Speed RAM
- Both TEAC 1.2 MB & 1.44 MB Floppy Disk Drives
- Maxtor 130 MB IDE Hard Drive (15ms)
- Local Bus Hi-Speed IDE Controller (70% Faster Than Standard ISA IDE)
- EPS 'Warp Speed' VESA Local Bus Card 1 MB VRAM (Optional 2 MB VRAM)
- EPS 14" 1024 x 768 Non-Interlaced SVGA Monitor .28 Dot Pitch
- 101 Enhanced Keyboard
- Baby Desktop Case w/6 Drive Bays
- MS WINDOWS 3.1
- MS DOS 5.0
- 3-Button 1600 DPI Mouse
- System User Manual
- 60-Day Money-Back Guarantee
- 3-Year Superior Warranty
- 1-Year On-Site Service, Extension Available
- Customizing Available

EPS Technologies

"a tradition of value and performance"

1-800-447-0921
ORDER TODAY TOLL FREE

FAX Orders 1-605-966-5482
Direct Line 1-605-966-5586
Tech Hot Line 1-800-526-4258
GSA Contracts #GSOOK91AGS5035-OPT1

EPS Technologies, Inc. 10069 Dakota Avenue
P.O. Box 278 Jefferson, SD 57038
Hours: 7am–7pm M–F, 9am–3pm Sat CST

All brands and product names mentioned are trademarks or registered trademarks of their respective holders. Prices are subject to change without notice. INTEL is a trademark of INTEL Corporation

matic method for converting a bitmapped font—or indeed any bitmapped picture—to outline form. But Fontographer gives you state-of-the art tools: It allows you to directly access a bitmapped font file, use a built-in autotracing utility to translate the bitmap information to vector form, then export the outline as a scalable font.

For a less-expensive type solution, consider the $149 FontMonger (Ares Software Corp., Foster City, Calif., 800-783-2737). This utility, which can convert from one font format (such as Agfa Intellifont) to another (Adobe Type 1, for example), does suffer one major drawback: It can't import bitmapped fonts directly. Salvaging the PCL fonts you've developed requires a third-party autotracing program to convert the bitmaps to vector information, which FontMonger can import in the form of editable .EPS files (also known as Adobe Illustrator format). The program can then export automatically hinted TrueType or Type 1 fonts.

You may already own an autotracing utility. If not, you'll find that adding tracing capabilities can be an expensive proposition. Among Windows programs of this sort, the two best known are Adobe Streamline, Version 3.0 ($195, Adobe Systems Inc., Mountain View, CA 94039, 415-961-4400); and CorelTrace, available only as part of a bundle with CorelDRAW, Version 3.0 ($595, Corel Systems Corp., Ottawa, Ontario, 613-728-8200).

At first glance CorelDRAW may seem outrageously expensive, but it could provide an all-in-one solution. Though meant as a vector-based illustration program, it shares certain features with FontMonger. Specifically, it can import editable .EPS files (generated with CorelTrace) and export either Adobe Type 1 or TrueType fonts. Unfortunately, CorelDRAW does not support hinting of any kind.

One important option actually lies in the question you didn't ask: "Are there font companies that are producing scalable fonts for the Armenian alphabet?" Yes, small type foundries in the U.S. specialize in foreign language alphabets. While Armenian fonts may not be as common as Greek, Japanese Katakana, or Cyrillic fonts, they are available. WorldFonts for Windows (Data-Cal Corp., Chandler, Ariz., 800-223-0123) produces an Armenian alphabet in both TrueType and Type 1 formats. If you purchase the $249 all-purpose version of WorldFonts, you get one font for each language mentioned above as well as truly esoteric alphabets like Estonian or transliterated Sanskrit. WorldFonts for Windows also includes a utility for mapping the new characters to your keyboard. A more modest investment of $99.95 allows you to purchase four fonts (Normal, Bold, Italic, and Bold Italic) in a standard serif typeface for any alphabet of your choosing. Please note that if you decide to buy the $99.95 all-Armenian font package you'll also have to pay an additional $99.95 for the utility program that maps the characters to your keyboard.—*Luisa Simone*

THE RIGHT DIRECTION

❓ I upgraded to a PostScript printer recently, specifically to take advantage of the .EPS (Encapsulated PostScript) file format. When I print in landscape mode, my text and pictures in other file formats (.TIF, for example) print correctly, but the .EPS files remain in portrait orientation. What's wrong, and how do I fix it?

Danielle Levine
Yorktown Heights, New York

▶**PC MAGAZINE:** The situation you describe is frustrating but easily fixed. The trouble actually lies with the Windows PostScript printer driver. A minor change to your WIN.INI file will turn the problem around—literally.

One reminder: When you change WIN.INI, *be sure* to use an editor that reads and writes pure ASCII text. The Windows Notepad provides an excellent tool for the job, but any ASCII-capable word processing program will do.

Scroll through the WIN.INI file until you find a section heading for your printer. The heading will be surrounded by brackets, and will include the name of your PostScript printer and the port to which it's attached, for example:

```
[Apple Laserwriter II NTX, LPT1]
```

(If you don't know what name Windows uses for your printer, look for the device= line in the [windows] section of WIN.INI—the name is the portion of that key's value up to the first comma.)

Immediately following this section heading you'll see important information specific to your printer, such as installed fonts and your default printer settings. For example, the number of copies will probably be set to 1, and the size of your paper will be set to letter.

Within this section but on a separate line, add the following statement:

```
LandscapeOrient=270
```

Save the file, exit, then restart Windows. Your imported .EPS files should now be properly rotated for landscape orientation.—*Luisa Simone*

Networking

MOVING TO UNSHIELDED TWISTED-PAIR WIRING

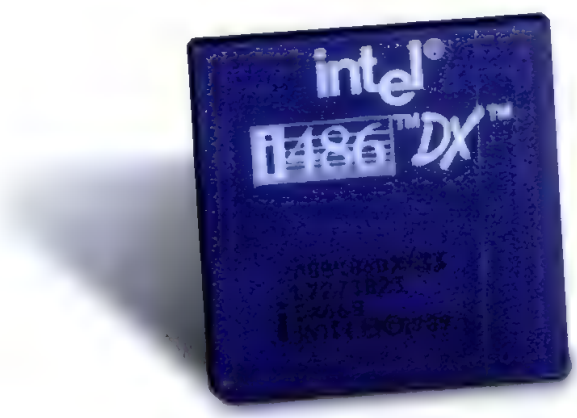
❓ Our Token-Ring network has been running over IBM Type 2 shielded twisted-pair wire for several years without problems, but we'll be moving soon and the technical department recommends that we switch to unshielded twisted-pair, since it's easier to install. We plan to step up to 100 megabit-per-second transmission in a few years, and I'm suspicious of the new wire. Can you make any recommendations?

Joe Kruczlnicki
Albany, New York

▶**PC MAGAZINE:** If properly selected and installed, unshielded twisted-pair wire will work fine for your present 16-megabit Token-Ring and future 100-megabit system—but that doesn't mean you shouldn't be suspicious of both the installation and the materials involved. In many ways the installer is more important than the manufacturer. Here's the key: Tell the contractor you want an installation that meets EIA/TIA 568 Category 5 standards using material with UL Level V marking.

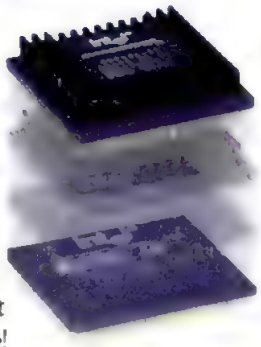
The EIA/TIA standards describe

FastMicro Finally Puts the 486 in Its Rightful Place!



FastMicro Maximizes Performance

Advanced Upgrade Path!



Not only do you get a high performance 486 PC today, but you can upgrade it tomorrow! Put a 33MHz FastMicro 486/Pro system on your desk and when you're ready for even more power, you can pop in an Intel OverDrive™ processor and boost performance even more!

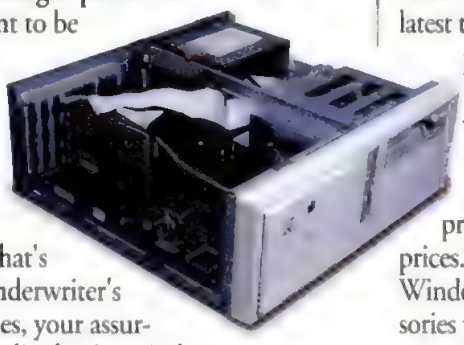
Your 486/Pro system is compatible with Intel's fastest processors so you're assured of state of the art performance now and a growth path tomorrow!

Dual Intelligent Cooling Fans: Only from FastMicro!

Every desktop FastMicro PC comes with dual cooling fans. It has a main fan that's quieter than fans in ordinary PCs - plus it includes a special second fan that comes on only when the system gets warm. A cooler system lasts much longer - a concern particularly when upgrading to higher heat-producing clock doubler chips.

Fourth Generation Case

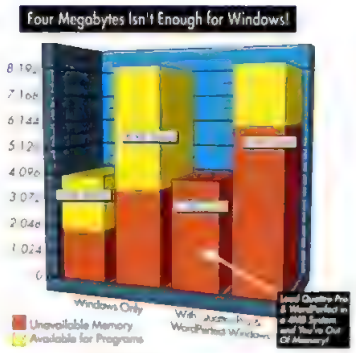
Our desktop case is uniquely engineered to provide the highest quality and maximum expandability in a space saving design. It has a total of seven drive bays to accommodate all of the storage options our customers tell us they want to be able to add in the future. It also has extra protection against electrical interference, unlike the weaker systems others sell. It also includes a power supply that's listed by Underwriter's Laboratories, your assurance of quality by America's most prestigious safety organization.



Conner 212Mb Higher Performance Drive.

FastMicro ups the ante with Conner's CP-30204 212mb IDE hard drive standard in 486/Pro systems. Conner has a reputation for building the most reliable drives on the market. Couple this with a 12 millisecond access time and up to 8MB/sec. data transfer rate and you won't want to gamble on a less reputable drive. No wonder Conner is now the #1 manufacturer of hard disks in the world!

Eight Megabytes of Memory!



Running Windows? Don't run out of memory! When Windows runs low on memory, it starts using your hard drive like memory. Memory is 200+ times faster than a hard drive - don't get caught short! FastMicro includes a full eight megabytes of RAM in every 486/Pro system.

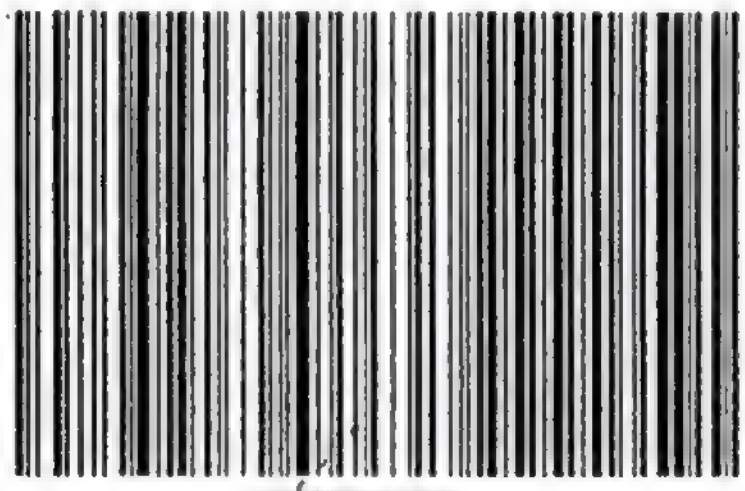
Start with FastMicro, Stay with FastMicro.

Why call one company to order your PC and another for everything else? FastMicro is the only leading system vendor that also advertises a full line of software, peripherals and more to complete your system and keep you abreast of all the latest technology products to maximize your computing productivity.

Four times a year, we'll send you our informative catalog featuring over five hundred PC products at low FastMicro prices. It features everything from Windows software to books, accessories to networking, and printers to games. FastMicro is truly your one-stop shop!

Inverted Back

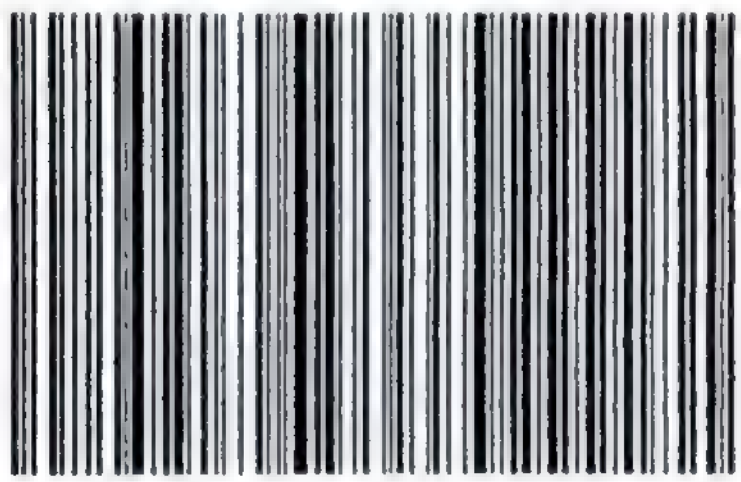
1. Follow instructions on the other side



Back

1. Follow instructions on the other side

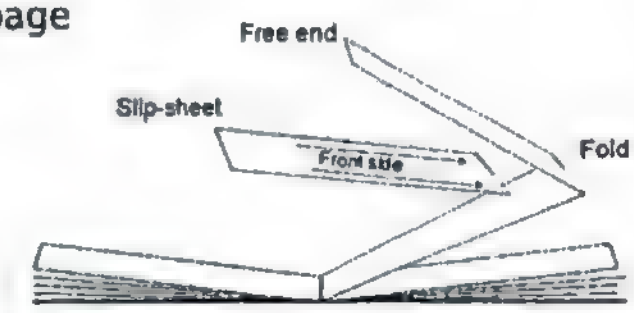
Folded edge of the page



GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



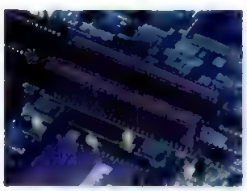
Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

FastMicro 486/Pro Video Power!

Dual VESA Standard!

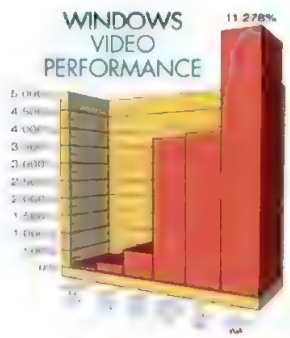
Settle for everything! While a few computer companies give you VESA local bus and even fewer give you a VESA standard monitor, FastMicro includes both!



VESA Standard Local Bus!

Why settle for slow video performance? FastMicro includes a high performance Windows accelerator combined with a VESA standard local bus!

Why is Local Bus faster? The i486DX is a high speed (33+ MHz) 32 bit processor. Video cards plug into a slot in your PC, called a bus connector. The standard PC bus was designed for an 8 MHz 286, therefore it's confined to 8 MHz and 16 bit. FastMicro's VESA Local Bus runs at 33MHz and 32 bit. Turn on your 486/Pro and watch Windows scream!



Why VESA? VESA Local Bus is a standard, unlike a proprietary local bus. You can upgrade your system in the future with third party VESA standard local bus peripherals. With your 486/Pro from FastMicro, you're not locked in.

Plus True Color Video!

No video card delivers more! FastMicro gives you the maximum number of colors possible for scanning, graphics, presentations and desktop publishing. Many systems can only do 256 colors, some can do 32,000 colors, FastMicro takes you to the limit with 16.7 million colors maximum! Plus FastMicro has all the latest VESA video options.

FastMicro Combines VESA Local Bus Performance with Windows Acceleration & over 16 Million Colors!

VESA Standard Flicker-Free Monitor!

Non-Interlaced monitors are not created equal. A non-interlaced monitor with less than a VESA standard refresh rate will flicker at high resolution modes! The resolution is the number of pixels (or 'dots') on the screen, the refresh rate is the speed in which the monitor redraws the screen. Don't be fooled.

VESA Standard Refresh Rates at 640x480, 800x600, & 1024x768!

Your new 486/Pro system from FastMicro includes VESA standard refresh rates at 640x480, 800x600, and 1024x768! Compare and don't settle for less, if other systems don't say it, they won't do it!

20% Larger Display with Edge-to-Edge Video!

In addition to eliminating annoying flicker when running in high resolution modes, FastMicro doesn't make you look at tiny characters either! Our new VESA standard display includes Edge-To-Edge video! 14" monitors are not created equal. You see, 14" is strictly the tube size, not the display area. FastMicro 486/Pro monitors are user adjustable for width, height, and position - just set to your preference and forget it.

Standard Non-Interlaced Monitors

FastMicro Edge-To-Edge Video!

You get more useable screen area than many 15" monitors. Edge-To-Edge video is really a lifesaver when running at 800x600 or 1024x768 Super VGA modes!

FASTMICRO
Graph Type
3D View
3D Options
Bar Type
Fill Color
Bkg Color
Fill Style
Border Color
Graph Button
2-D
3-D
Rotate
Combo
Text
OK
Cancel
Help
Edit Block Data Tools Graph Draw
Window Help
National Defense Spending as % of GNP
10%
8%
6%
4%
2%
0%
Vietnam War
Program Manager - [Graphics Weekly]
File Options Window Help
Winword
Windows Draw 3.0
Winchart
PhotoMagic 1.0
FASTDATA 486
TURBO
RESET

Inside the New FastMicro 486/Pro!

FastMicro 486/Pro Series - Don't Settle for Less!

4DX/33 $1999

4DX2/66 $2399

- i486™ Processor with 8K Internal Cache.
- High Speed 128K External Static RAM Write-Back Cache.
- Upgradable to OverDrive™ Processors.
- 8 megabytes of high speed RAM.
- 212mb 12ms Conner IDE hard disk.
- 1.2mb 5.25" & 1.44mb 3.5" Toshiba floppy drives.
- VESA Local Bus SVGA Windows Accelerator Card with 16.7 Million Colors Maximum.
- VESA Standard Non-Interlaced 14" Super VGA color monitor with 800x600 @ 72hz & 1024x768 @ 70hz and Edge-To-Edge Video.
- Dual Intelligent Cooling Fans.
- Clock calendar, parallel port, game port and two serial ports.
- 8 expansion slots, 2 occupied.
- Fourth Generation Desktop Case.
- 200 Watt UL Listed Power Supply.
- Microsoft DOS.
- Microsoft Windows 3.1
- Microsoft Serial Mouse.
- Choice of Two Major Software Applications: WordPerfect for Windows, Quattro Pro for Windows, Paradox, PC Tools and/or Graphics Works for Windows.
- FastMicro Peace of Mind.

Legendary FastMicro Service

FastMicro backs up all FastData PC's with the most comprehensive service in the business. Seven day a week toll-free technical support is included for as long as you own your FastData PC. In the unlikely event a part should fail during the one year warranty, we'll express ship you the replacement part. If we still can't resolve the problem, we'll send GE on-site or replace the system at no charge.

GE Computer Service

Satisfaction Guaranteed

We'd love to add you to the FastMicro family of satisfied customers. Every FastData 486 PC comes with our 30 day money back satisfaction guarantee.

But if you're like the majority of our customers, you'll be very satisfied. After all, at FastMicro, we want you as a customer for life - not just today.

© 1992 FastMicro, Inc. 4405 E. Baseline Rd. Phoenix, AZ 85044. fax 602-431-8300 All major credit cards accepted. Prices and money back guarantee do not include 3% shipping. i486, Intel Inside, and OverDrive are trademarks of Intel Corporation. All other trademarks acknowledged. Due to volitile memory costs, prices are subject to change before you order.

FASTMICRO 1-800-824-6000

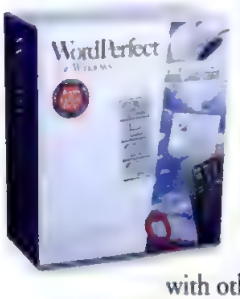
High Performance Software Included Too!

Start with Windows & a Genuine Microsoft Mouse!

With FastMicro 486/Pro systems you get more! Of course you get the latest versions of Microsoft DOS and Windows preinstalled. But unlike most of our competitors, we include a true Microsoft mouse, not the lowest price mouse we could find.

Take Two - Get up to $700 Worth of Software

The best computer deserves the best software and FastMicro includes some of today's hottest software at no extra charge! Choose any two of the following titles and you'll get the latest versions complete and ready to run. Everything's included and you get full manufacturer support (unlike some other 'bundles'). The products come in special FastMicro boxes - retail boxes shown.



WordPerfect for Windows

WordPerfect is the #1 selling word processing software and the Windows version is loaded with features. It includes the ability to create & edit tables, equations, lists and graphics. You can even edit graphics created with other programs! Plus, it works with your WordPerfect for DOS files and uses familiar WordPerfect commands so your transition to Windows is easy.

PC Tools 8.0

The latest version of the top selling utility software! PC Tools 8.0 adds an all new DOS desktop with integrated application menu & manager, file viewer & manager, scheduler, and desk accessories. You also get Central Point's award-winning backup and a hot new version of Anti-Virus. PC Tools also includes DiskFix, FileFix, Undelete, Unformat, Disk Edit, Defragmenter, Cache and more! Central Point Commute lets you remotely run Windows or DOS applications and you get new RamBoost Memory Optimizer too!

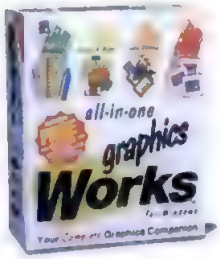
Quattro Pro for Windows

"Quattro Pro for Windows is worth the wait" proclaims PC Magazine. QPW uses spreadsheet notebooks to easily organize your spreadsheets. Click your right mouse button and Object Inspectors lets you change attributes instantly! Speedbars give you those one-click shortcuts that change depending on what you're working on! Interface Builder lets you build applications without programming. "QPW comes with a separate Database Desktop application -a beautifully designed query-by-example tool" says PC Magazine, "QPW's graphs are gorgeous and include rotatable 3-D types as well as options to adorn them." Need we add more?

Paradox 4.0

Paradox is the most advanced relational database ever created for the PC. Now it's the fastest. For first time users or application developers, Paradox provides the ease of use and power you need! New Application Workshop, Paradox's application generator, lets you easily develop custom applications. Paradox also has automatic multiuser support and is network ready. Combine this with the full suite of development tools and SQL connectivity and Paradox is the database of choice!

Graphics Works for Windows



With five applications in one, Graphics Works from Micrografx gives you complete graphic tools for Windows. Includes Windows Draw! - the hot selling package that lets you create graphics compatible with your other Windows programs. It also includes new Photo Magic! - the photo editing software that comes with hundreds of photos you can use as-is or modify and use in your documents (plus you'll have photo realism on-screen with FastMicro's true color video). You get a charting tool and the leading organization charting software for Windows. Plus you get a bonus CD with over 1,000 photos and 10,000 pieces of clip art you can use as-is or customize with Graphics Works!

Why settle for less?
FastMicro includes the real thing: a Microsoft Mouse.

True Intel 486 for Less Than $1,000!

Introducing FastMicro's 486/Valueline.

Don't need all the extra features of our 486/Pro Series? Then the 486/Valueline is right for you. This system is truly a price breakthrough! FastMicro delivers a high performance 486 system at a low end price. Others can only offer a 386/SX for less than $1000 or substitute an imitation 486 that's more like a 386, FastMicro puts 25MHz 486SX power in your hands. Plus this isn't a 'bare' system, you get a system that's complete and ready-to-run right out of the box, including a Super VGA color monitor and card.

Loaded with Memory & Storage

FastMicro also includes four full megabytes of high-speed SIMM memory! You can even expand the memory to a total of 32MB. Of course, how can you also expect to get a hard drive at this price? Well, FastMicro includes a quality Conner hard drive with an unbelievable 85MB capacity. Plus, since it's a standard IDE drive, you can easily add a second hard drive later.

Upgradable to OverDrive Processors!

The best part of this system is that you get legendary FastMicro upgradability too! Besides upgrading the memory and drive, you can upgrade later to a faster Intel processor. This system is completely Intel OverDrive™ compatible; which means you can upgrade your FastData 486 system all the way to a 66 MHz 486DX/2! And like all FastMicro systems, you can upgrade monitors, drives, etc. when you order.

Plus, It's from FastMicro!

Pay less and get more! FastMicro backs up this system with seven day a week toll-free technical support and express parts replacement at no extra charge. And should you have an unusual problem, we'll send GE on-site service or replace the system at no additional cost! We also include BBS support and a 30 day money-back satisfaction guarantee too! Try a FastMicro 486/Valueline PC, you'll agree that they offer a lot of power for the price.

GE Computer Service

4SX/25 $999

- i486SX™ 25mhz Processor with 8K Internal Cache & 64K Static Ram Cache.
- 486 OverDrive™ Processor Upgradable.
- 4 megabytes of high speed RAM.
- 85 mb 17ms IDE hard disk,.
- 1.44mb 3.5" floppy drive.
- Mini-Tower Chassis.
- 14" SVGA monitor, 1024x768 resolution.
- 16 bit SVGA card.
- Clock calendar, parallel port, game port and two serial ports.
- 6 expansion slots, 2 occupied.
- Microsoft DOS 5.0.

FASTMICRO

1-800-821-9000

© 1992 FastMicro, Inc Prices and money back guarantee do not include shipping. FastMicro 486/Value models do not include extras that 486/Pro models do.

technical factors including the maximum allowable distance for specific types of wire, how much the signal degrades or attenuates across the cable system, the amount of electrical noise the wires absorb from equipment in the building, and the level of electrical signaling one pair of wires absorbs from an adjacent pair of wires—what is termed near-end crosstalk. When installers plan the wire runs, select terminal equipment, and configure the individual wires, they impact several of these important measurements, particularly the level of noise and the amount of crosstalk. The UL markings show that the materials meet specific portions of the fire code and also meet the minimal technical requirements necessary to a good installation. You can't have a good installation without good equipment, but using the best equipment doesn't guarantee a good installation.

As a part of the job, the firm you hire should supply a set of charts showing the attenuation, noise, and near-end crosstalk of each installed wire pair. The allowable measurements depend on whether you are using 4-megabit Token-Ring, 16-megabit Token-Ring, or 10Base-T, but the installer should know the limits. This type of installation isn't cheap because it requires many hours of skilled labor. Even in new buildings (which are designed to handle cabling), though, it's still easier to run many pairs of high-quality unshielded wire through conduits and shafts than to pull thick, shielded twisted-pair cables. In fact, the trend is toward exclusive use of unshielded twisted-pair to the desktop, but this wire is only fully effective in a properly configured and tested installation.—*Frank J. Derfler, Jr.*

MODEM CONNECTIONS TO PBX PHONES

❓ We have a sophisticated new telephone system that employs digital phones. Unfortunately, we know of only one reliable way to use our existing (standard) modems with the recently acquired equipment—by installing analog cards in the PBX and then running a second line from these to each user's station. It's an expensive solution, though, and the system's managers are reluctant to downgrade their new hardware with analog technology. We could share a pool of modems at the PBX, but it's complicated and—in our experience—undependable. Is there some way to attach a regular modem to a digital PBX telephone?

Bill Walsh
Chicago, Illinois

▶**PC MAGAZINE:** So you want to go from your digital computer to an analog modem to a digital PBX and out to a digital telephone central office from which you'll eventually connect to another analog modem attached to a digital computer? Believe it or not, so do many other people. Digital PBX systems are the standard today, but it's often difficult or impossible to make a modem connection without installing a separate and expensive outside line or analog line card. Luckily, a company called Unlimited Systems in San Diego, California (619-277-3300), markets a product just for you—the Konexx Konnector.

The telephone's only analog port is its handset. The Konnector attaches there via the jack, allowing your analog modem's tones to feed into the digital phone. The $149 device works with any telephone that has a modular jack (but not a dialer) in the handset. It converts the four-wire handset port to a two-wire RJ-11 modem port, handles the necessary impedance transformation, and controls the line level. Because of the excellent electrical connection, the Konnector will work at all modern modem speeds.

Although the Konnector is meant to solve the problems of interfacing to digital telephones, it also comes in handy for those who have been stumped trying to connect a modem to the phone in a hotel room. Unlimited Systems also makes two other products for you hotel communicators. The Konexx Koupler is a high-quality acoustic coupler that contains its own battery and provides clear tones to the handset. The $149 device adjusts to fit a wide variety of handsets. It also comes as part of a $169 Konexx Kit that includes a screwdriver, cords with alligator clips, and everything else that a frustrated traveling communicator could need.
—*Frank J. Derfler, Jr.*

Languages

ACCESSING VIDEO MEMORY

❓ Can you tell me how to access the PC's video memory directly? I am interested in performing animation, but the routines provided by high-level languages either don't do what I want or are simply too slow.

Gabriel Shapiro
Albany, New York

▶**PC MAGAZINE:** While high-level languages provide routines for manipulating video images, many users cannot resist the temptation to write to the video card directly. Great performance improvements can be achieved by writing directly to the hardware, but at the cost of tying the program to a specific hardware implementation.

I've written two programs, one in BASIC and the other in C, to show you how to access the video buffer directly. In both cases, the programs perform a small amount of animation and then terminate. Although they are simple, the programs demonstrate the techniques necessary for direct video memory access. Before discussing them, however, some background should help.

Since the original PC, the basic design of video hardware has remained fairly unchanged. All PCs, from the original IBM PC in 1981 to those of today, use a memory-mapped video design that makes changing what appears on-screen as simple as writing a byte to memory. As new video standards have evolved, they have remained backward-compatible with the original Monochrome Display Adapter (MDA) and Color Graphic Adapter (CGA.)

Video cards in the PC can be set to two basic modes: text and graphics. In text mode, the video memory is divided into 2-byte cells that describe what will appear in a character cell on the screen. One byte specifies the character to be written while the other byte specifies the color and other display attributes.

In graphics mode, each point on the screen is individually set depending on a bit or group of bits in the video memory. While the examples I'll present here only

"Tri-Star Computer Corporation is well known for its high performance CAD and LAN systems..."

—Computer Shopper January 1993

"Outstanding EISA values include the Tri-Star 486, with its great disk performance and generous expansion in a roomy file-server case. If you need a low cost EISA file server the Tri-Star is a worthy choice." *PC Magazine* Honorable Mention 9•15•92

"...rates an honorable mention for its thoughtful design touch and two year warranty. Consider this tower if you are looking for a top notch file server."
PC Magazine
486 Honorable Mention
September 11, 1990

intel inside

TRI-STAR
COMPUTER CORPORATION
1 800 755 1000

Tri-LAN EISA SCSI Server

INTEL 80486 66 MHz DX2 PROCESSOR
8MB RAM (EXPANDABLE TO 64MB)
256K SECONDARY RAM CACHE
EISA SCSI 32-BIT BUS MASTER CONTROLLER
525MB SCSI-2 HARD DRIVE
8 EISA EXPANSION SLOTS
COMBO TEAC 1.2MB & 1.44MB FLOPPY DRIVES
14" SVGA COLOR DISPLAY
101-KEY KEYBOARD

$3295
With 1.2GB SCSI Hard Drive
$3995
With 1.7GB SCSI Hard Drive
$4395

Tri-LAN EISA Dual SCSI Server

Includes Two Removable SCSI Hard Drives to support disk mirroring under Novell and SCO. Disk mirroring is the first and most important step in creating a fault-tolerant Server.

Dual 525MB **$4295**
Dual 1.2GB **$5695**
Dual 1.7GB* **$6495**
*Non-removable

Take Disk Mirroring one step further by adding a secondary EISA SCSI Bus Master Controller to your Server to achieve Disk Duplexing. Disk Duplexing offers a greater level of Fault Tolerance.

Secondary SCSI Controller Only $275

Tri-LAN DISK ARRAY SCSI Server

Three 340MB **$5499**
Three 525MB **$6699**
Three 1.2GB **$8699**

OPTIONS
32-Bit Ethernet Adapter **$299**
SCSI 265ms CD-ROM **$399**
2GB Tape Backup **$1089**

SCSI DISK ARRAY

Utilizing an Ultrastor 124F RAID SCSI Host supporting a three channel SCSI disk array that increases server data transfer response times dramatically. RAID provides optimum server performance and optimum fault tolerance.

CIRCLE 121 ON READER SERVICE CARD

Micron
Means
Quality

PC MAGAZINE
EDITORS' CHOICE

January 26, 1993
466 Magnum

"...the most advanced thinking, systems design, integration, and construction we've seen yet."

Jim Seymour, PC Magazine, January 26, 1993

Micron Means Memory

Semiconductors to Systems

Driven by quality, Micron has gained worldwide recognition as a leading semiconductor manufacturer. Founded in 1978, Micron's facilities now span over one million square feet, with more than 4,500 dedicated employees and annual revenues exceeding one-half billion dollars. Quality Micron memory components can be found in everything from personal computers to advanced military applications, giving new dimensions to the words "Made in the U.S.A."

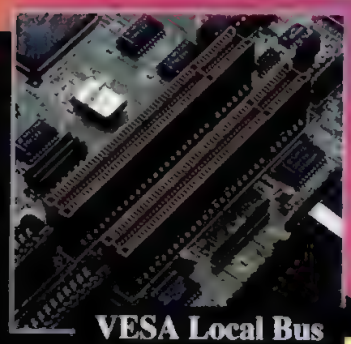
Built on our semiconductor success, Micron continues the legacy by designing high performance systems with the same attention to quality every step of the way. Our unique experience, advanced technology and stringent reliability standards add up to valuable advantages for you and your company. From semiconductors to personal computers, Micron sets the standards by which others are judged.

intel inside

Micron Means Systems

Pentium™ Ready

At the heart of every Micron 486VL system is a Zero Insertion Force (ZIF) socket designed for Intel's Overdrive™ and Pentium microprocessors. Upgrades are made easily with our "Tool Free" chassis and it's single thumbscrew design.



VESA Local Bus

Micron 486VL systems feature VESA Local Bus compliant 32-Bit high performance video and disk controllers. VL-Bus IDE and SCSI II caching controller options provide up to 50 times faster access with a 400% increase in data transfer rates.

Weitek™ P9000

The Weitek Power 9000 graphics processor produces over 50 Million WinMarks for the ultimate in local bus graphics performance. With 2MB of Micron VRAM standard, you'll get more colors at higher resolutions for photo-graphic quality images

"This cutting-edge piece of technology has accelerated the pace of desktop computing . . ."

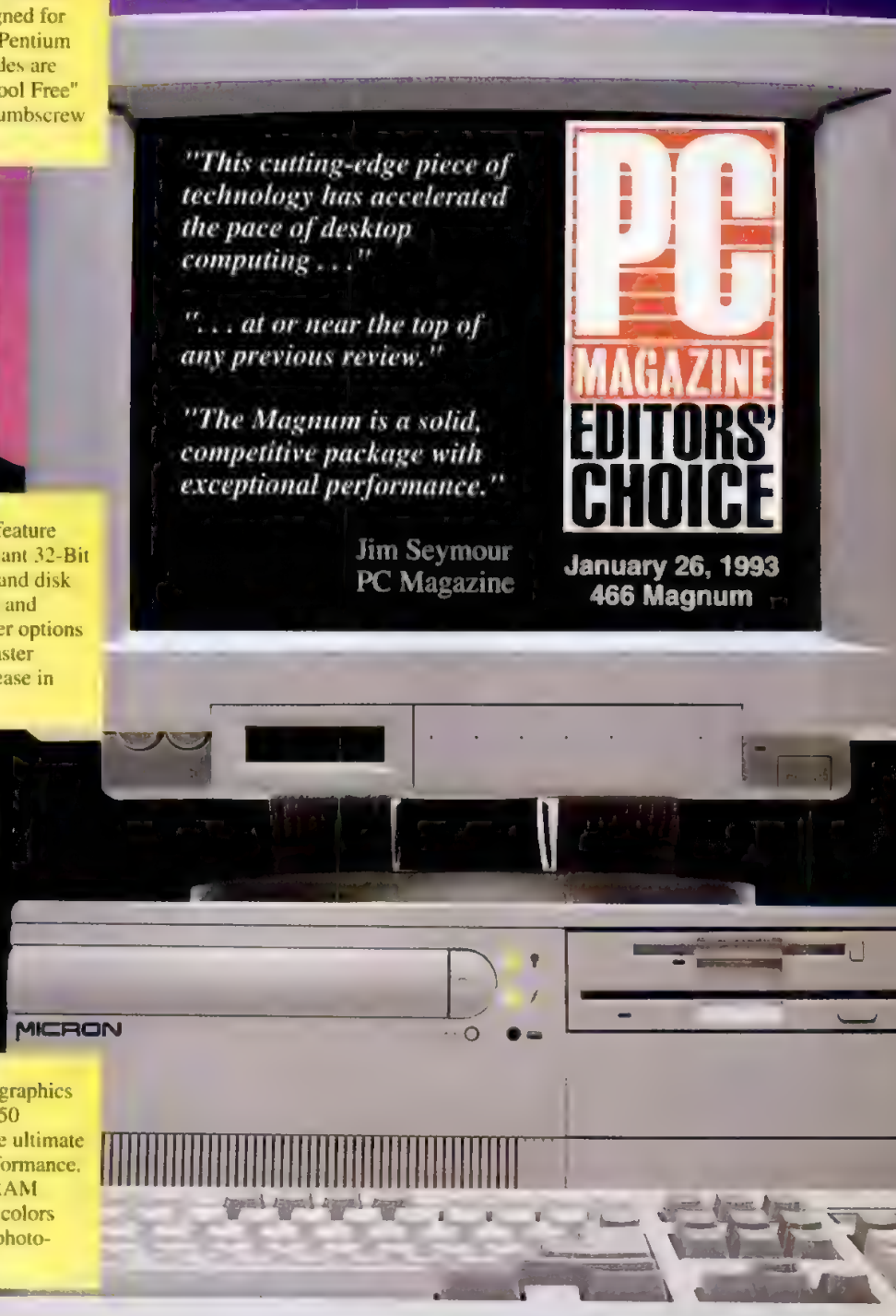
". . . at or near the top of any previous review."

"The Magnum is a solid, competitive package with exceptional performance."

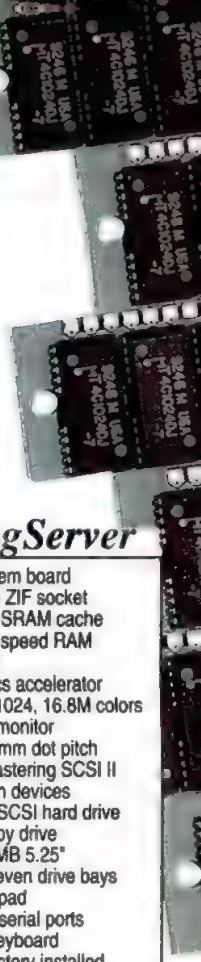
Jim Seymour
PC Magazine

PC MAGAZINE
EDITORS' CHOICE

January 26, 1993
466 Magnum



Micron Means Business



486VL Magnum

- VESA Local Bus system board
- Intel™ 486™ processor in ZIF socket
- 256K of Micron® **15ns** SRAM cache
- **8MB** of Micron high-speed RAM
- Edge® VL24 BitBlaster™ VL-Bus 32-bit graphics accelerator **2MB** RAM, 1280 x 1024, 16.8M colors
- 14" SuperVGA color monitor NI at 1024 x 768, .28mm dot pitch
- VESA Local Bus 32-bit IDE controller
- Maxtor® **213MB** 15ms IDE hard drive
- Teac® dual media floppy drive 1.44MB 3.5" and 1.2MB 5.25"
- Desktop chassis with five drive bays and "Tool Free" design
- Logitech® mouse and pad
- 1 parallel, 1 game, 2 serial ports
- 101-Key enhanced keyboard
- Microsoft® DOS® 5.0 factory installed

433•$1999 450•$2199
466•$2399 466•$2699
EISA

PC MAGAZINE EDITORS' CHOICE
January 26, 1993
486 Magnum

486VL WinStation

- VESA Local Bus system board
- Intel 486 processor in ZIF socket
- 256K of Micron **15ns** SRAM cache
- **16MB** of Micron high-speed RAM
- VL-Bus 32-bit graphics accelerator Weitek™ P9000, 50 million WinMarks **2MB** VRAM, 1280 x 1024, 16.8M colors
- 15" MAG™ SuperVGA color monitor NI at 1280 x 1024, .28mm dot pitch
- VESA Local Bus 32-bit IDE controller
- Maxtor **245MB** 15ms IDE hard drive
- Teac dual media floppy drive 1.44MB 3.5" and 1.2MB 5.25"
- Desktop chassis with five drive bays and "Tool Free" design
- Logitech mouse and pad
- 1 parallel, 1 game, 2 serial ports
- 101-key enhanced keyboard
- Microsoft DOS 5.0 factory installed

433•$2599 450•$2799
466•$2999 466•$3299
EISA

PC MAGAZINE EDITORS' CHOICE
January 26, 1993
486 Magnum

486VL MagServer

- VESA Local Bus system board
- Intel 486 processor in ZIF socket
- 256K of Micron **15ns** SRAM cache
- **16MB** of Micron high-speed RAM
- Edge VL24 BitBlaster VL-Bus 32-bit graphics accelerator **2MB** VRAM, 1280 x 1024, 16.8M colors
- 14" SuperVGA color monitor NI at 1024 x 768, .28mm dot pitch
- VL-Bus 32-bit bus mastering SCSI II controller, up to seven devices
- Maxtor **1.2GB** 13ms SCSI hard drive
- Teac dual media floppy drive 1.44MB 3.5" and 1.2MB 5.25"
- Tower chassis with seven drive bays
- Logitech mouse and pad
- 1 parallel, 1 game, 2 serial ports
- 101-Key enhanced keyboard
- Microsoft DOS 5.0 factory installed

433•$3799 450•$3999
466•$4199 466•$4499
EISA

486VL ValueLine

- VESA Local Bus system board
- Intel 486 processor in ZIF socket
- **4MB** of Micron high-speed RAM
- Edge VL24 BitBlaster VL-Bus 32-bit graphics accelerator **2MB** RAM, 1280 x 1024, 16.8M colors
- 14" SuperVGA color monitor, NI at 1024 x 768, .28mm dot pitch
- VESA Local Bus 32-bit IDE controller
- Maxtor **120MB** 15ms IDE hard drive
- Teac 1.44MB 3.5" floppy drive
- Desktop chassis with five drive bays and "Tool Free" design
- Logitech mouse and pad
- 1 parallel, 1 game, 2 serial ports
- 101-key enhanced keyboard
- Microsoft DOS 5.0 factory installed

433S • $1499
433•$1699 450•$1899
466•$2099 466•$2399
EISA

486DXL Color Notebook $2699

- Intel 486DXL 25MHz processor 8K cache and math coprocessor
- 4MB of high speed RAM (to 16MB)
- 80MB removable hard drive
- Color VGA display 640 x 480
- Dimensions: 9.4" x 12.2" x 2"
- Weight: 7.1 lbs with battery
- Suspend / Resume feature
- Full size 86-Key/keyboard
- 1.44MB 3.5" floppy drive
- Advanced Power Management
- 1 parallel, 1 VGA, 2 serial ports
- A/C charger / adapter
- Carrying case included
- Microsoft DOS 5.0 factory installed

Upgrades

- VL-Bus 32-bit IDE caching controller
- VL-Bus 32-bit SCSI II caching contoller
- Multimedia Kit
- MAG 17" Super VGA color monitor
- MAG 21" Super VGA color monitor
- Vertical tower chassis

intel inside

ON-SITE SERVICE

- SAME DAY SHIPPING ON MOST SYSTEMS
- 30 DAY RISK-FREE MONEY BACK GUARANTEE
- ONE YEAR EXPRESS PARTS REPLACEMENT
- LIFETIME TOLL-FREE TECHNICAL SUPPORT
- ONE YEAR ON-SITE SERVICE OR SYSTEM REPLACEMENT

MICRON COMPUTER, INC.

Formerly Edge Technology, Inc.

800-438-3343

MON-FRI 7AM - 8PM,
SAT 8AM - 5PM(MST)

915 E. Karcher Road - Nampa, Idaho 83687
(208) 465-3434 - FAX (208) 465-3424

©1993 Micron Computer Inc. All rights reserved. All prices and specifications subject to change without notice. Micron Computer Inc. cannot be responsible for omissions, errors in typography or photography. Intel and Intel Inside are registered trademarks of the Intel Corporation. All other company trademarks are those names of each respective company. Prices do not include shipping or handling. Micron Computer Inc. reserves the right at its sole discretion to either dispatch on-site service or replace systems. On-site service provided by third party servicer and may not be available in some remote locations. 30 day risk-free money back guarantee does not include return freight or shipping and handling charges and applies only to Micron brand products. All returns require RMA numbers and must be shipped in the original condition packed and insured.

CIRCLE 119 ON READER SERVICE CARD

Quantum Leap Performance

Thunderous Speed with The New Generation Weitek & S3-805 Graphics Accelerator

EISA WinStation (VL-Bus)

- 64K Fast Cache SRAM & Expandable to 256K
- 4 MB RAM & Expandable to 128MB
- 1.2 MB 5.25" & 1.44 MB 3.5" Floppy Drives
- **170 MB** 15ms IDE 64K Cache Drive
- 32-Bit EISA Hard Disk Controller (4X faster DTR)
- 32-Bit VL-Bus WinMax **S3-805** Graphics Accelerator w. 1MB RAM (Up to 1280x1024 & 16.7M True Colors)
- 14" Non-interlaced .28mm Super VGA Monitor (1280x1024 with 15% larger edge to edge display)
- 2 Serial, 1 Parallel & 1 Game Ports
- Enhanced 101-key Keyboard
- Hi-Resolution 400DPI Serial Mouse
- Free Microsoft DOS 5.0 & Windows 3.1

486/33 DX	$1945
486/50 DX2	$2065
486/50 DX	$2195
486/66 DX2	$2295

- 8 MB RAM & **250 MB** 12ms Drive Add $280
- **SONY** MultiMedia Pro Package Add $545

VESA Local Bus WinStation

- 64K Fast Cache SRAM & Expandable to 256K
- 4 MB RAM & Built-in 487 Math Coprocessor
- 1.2 MB 5.25" & 1.44 MB 3.5" Floppy Drives
- **170 MB** 15ms IDE 64K Cache Drive
- 32-Bit VL-Bus WinMax **S3-805** Graphics Accelerator w. 1MB RAM (Up to 1280x1024 & 16.7M True Colors) (Up to 50X faster than standard SVGA)
- 14" Non-interlaced .28mm Super VGA Monitor (1280x1024 with 15% larger edge to edge display)
- 2 Serial, 1 Parallel & 1 Game Ports
- Enhanced 101-key Keyboard
- Hi-Resolution 400DPI Serial Mouse
- Free Microsoft DOS 5.0 & Windows 3.1

486/33 DX	$1775
486/50 DX	$2055
486/66 DX2	$2125

- 8 MB RAM & **250 MB** 12ms Drive Add $280
- 32-Bit VL-Bus Hard Disk Controller Add $60

VESA Local Bus Tornado

- 64K Fast Cache SRAM & Expandable to 256K
- **8 MB** RAM & Built-in 487 Math Coprocessor
- 1.2 MB 5.25" & 1.44 MB 3.5" Floppy Drives
- 32-Bit **VL-Bus** Hard Disk Controller (2X faster)
- **250 MB** Ultra Fast 12ms IDE 64K Cache Drive
- 32-Bit VL-Bus WinMax **S3-805** Graphics Accelerator w. 1MB RAM (Up to 1280x1024 & 16.7M True Colors) (2.5X faster than ATI Ultra Pro in CAD test)
- 15" Flat Screen .28mm 1280x1024 SVGA Monitor
- 2 Serial, 1 Parallel & 1 Game Ports
- Enhanced 101-key Keyboard
- Hi-Resolution 400DPI Serial Mouse
- Free Microsoft DOS 5.0 & Windows 3.1

486/33 DX	$2195
486/66 DX2	$2545

- 17" Flat Screen 1280x1024 Monitor Add $440
- VL-Bus Weitek 9000 (63M WinMark) VGA Add $250

"The Intel Inside Logo is a trademark of Intel Corporation"

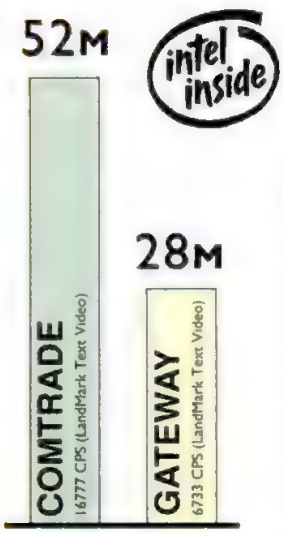
VESA Standard Local Bus Now.

ONCE AGAIN **"THE LIGHTNING COMTRADE PC"** HAS THE COMPETITION RUNNING FOR COVER. IN REVIEW AFTER REVIEW, CRITIC'S APPLAUD COMTRADE SHOCKING SPEED AND EXTRAORDINARY VALUE. ACCORDING TO THE LATEST PC MAGAZINE, COMTRADE'S 486 "HAS THE PERFORMANCE ISSUE LICKED." SO MUCH SO THAT PC MAGAZINE RANKED COMTRADE'S 486 EISA WINSTATION NUMBER 2 OUT OF 63 SYSTEMS IN THEIR 486 REVIEW **"MOST BANG FOR THE BUCK"** ANALYSIS (SEPTEMBER 1992). "IT'S A VERY SWIFT GRAPHICS MACHINE," SAYS COMPUTER SHOPPER (MAY 1992). "THAT DESERVES SERIOUS CONSIDERATION FROM ANYONE WHO WANTS TO JUICE UP WINDOWS." AND NOW FASTER THAN EVER, COMTRADE'S NEW GENERATION VESA LOCAL BUS WINMAX S3-805 IS EVEN 3 TO 5 TIMES FASTER THAN ANY OF OUR PREVIOUSLY REVIEWED SYSTEMS.

Comtrade Kicks Gateway's Bus!

In Comparison With Gateway 2000's VESA Local Bus ATI Ultra Pro.

CIRCLE 316 ON READER SERVICE CARD



READ THE BENCHMARKS AND WEEP. COMTRADE'S LATEST VESA STANDARD LOCAL BUS PASSES THE OTHERS LIKE THEIR STANDING STILL. NOT ONLY DOES COMTRADE VL-BUS WINMAX S3-805 BEAT ATI VL-BUS ULTRA PRO HANDS DOWN IN OVERALL WINDOWS PERFORMANCE TEST, IT IS ALSO UP TO **2.5 TIMES** FASTER IN THE DOS TEXT MODE (LANDMARK) AND CAD/CAM (WINTACH) TEST. COMBINE THIS UNPRECEDENTED PERFORMANCE WITH A SOLID REPUTATION FOR QUALITY AND SERVICE, AND A VERY COMPETITIVE PRICE - AND IT'S NO WONDER COMPUTER SHOPPER (NOVEMBER 1992) CALLED THE COMTRADE 486 "A SPLENDID SYSTEM BACKED BY FIRST RATE SUPPORT."

Based on WinMarks 2.5 as of NOV 1992

***Million Pixels Per Second (486/66 DX2)*
Standard SVGA has only 1.2M WinMarks
VL-Bus TSENG ET-4000 has only 3.2M WinMarks

- **We Stand Behind Our Products** -

Two Year Parts & Labor Warranty
One Year Nationwide On-Site Service
30-Day Money Back Guarantee

EISA Dream Machine (VL-Bus)

- The Ultimate EISA System with VL-Bus Accelerator
- 256K Ultra Fast Write Back Cache SRAM
- **8 MB** RAM & Expandable to 128 MB
- 1.2 MB 5.25" & 1.44 MB 3.5" Floppy Drive
- **250 MB** Ultra Fast 12ms IDE 64K Cache Drive
- 32-Bit EISA Hard Disk Controller (4X faster DTR)
- 32-Bit VL-Bus WinMax **S3-805** Graphics Accelerator w. 1MB RAM (Up to 1280x1024 & 16.7M True Colors) (Up to 50X faster than standard SVGA)
- 15" Flat Screen .28mm 1280x1024 SVGA Monitor
- 2 Serial, 1 Parallel & 1 Game Ports
- Enhanced 101-key Keyboard
- Hi-Resolution 400DPI Serial Mouse
- Free Microsoft DOS 5.0 & Windows 3.1

486/33 DX	$2345
486/50 DX2	$2475
486/50 DX	$2595
486/66 DX2	$2695

- 17" Flat Screen 1280x1024 Monitor Add $440

EISA SCSI-2 (VL-Bus)

- 64K Fast Cache SRAM & Expandable to 256K
- **8 MB** RAM & Expandable to 128MB
- 1.2 MB 5.25" & 1.44 MB 3.5" Floppy Drives
- 32-Bit EISA Bus-Master SCSI-2 Hard Disk Controller (25X faster Data Transfer Rate & 0.2ms Access Time)
- **210 MB** 12ms SCSI-2 Drive with 64K Cache
- 32-Bit VL-Bus WinMax **S3-805** Graphics Accelerator w. 1MB RAM (Up to 1280x1024 & 16.7M True Colors) (Up to 50X faster than standard SVGA)
- 14" Non-interlaced .28mm Super VGA Monitor
- 2 Serial, 1 Parallel & 1 Game Ports
- Enhanced 101-key Keyboard
- Hi-Resolution 400DPI Serial Mouse
- Free Microsoft DOS 5.0 & Windows 3.1

486/33 DX	$2395
486/50 DX	$2645
486/66 DX2	$2745

- 15" Flat Screen 1280x1024 SVGA Monitor Add $140

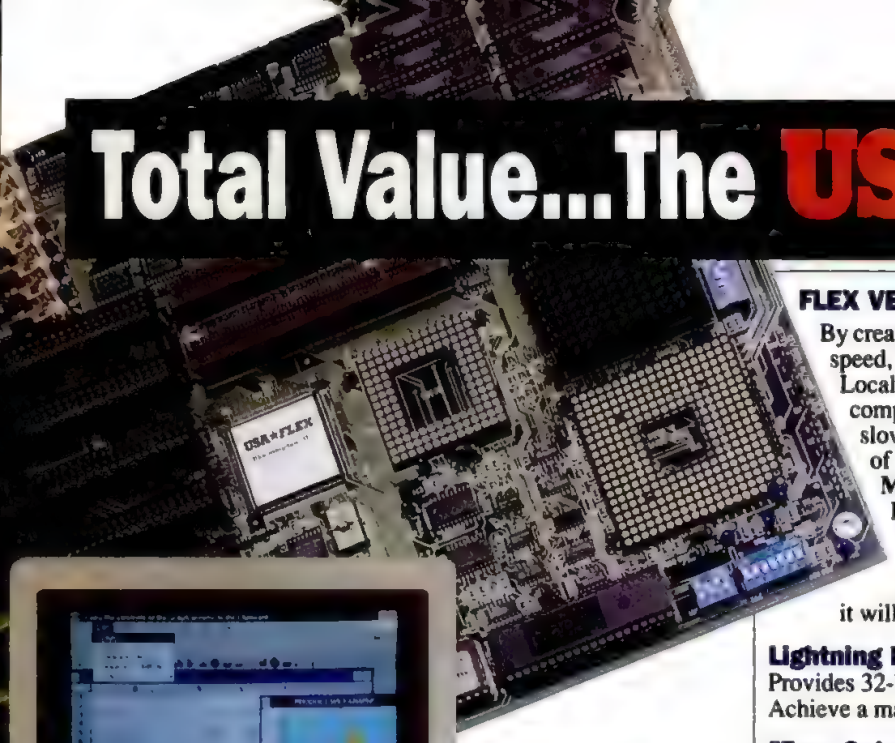
1.800.969.2125

COMTRADE

"Where Quality is Everything"

International 818.961.6688
Fax 818.369.1479
Tech Support 800.899.4508
24-Hour BBS Service 818.961.6098
Hours: 7:00-7:00 Pacific Mon-Sat
15314 East Valley Boulevard
City of Industry, California 91746

Total Value...The USA FLEX 48



Starting As Low As...

$1499

intel inside

MICROSOFT WINDOWS READY-TO-RUN

FLEX VESA Local Bus Blazing Speed, Great Price!

By creating a 32-bit wide path running at the system's clock speed, the bus throughput performance of our FLEX VESA Local Bus System is improved almost 400% versus a comparable EISA system. Frustrating "traffic jams" that slow down video and hard drive performance are a thing of the past.

Meets VESA Standard And Is Upgradeable

Designed and built to meet VESA standards with two VESA Local Bus Slots and offering an additional six 16-bit slots, means your investment is protected against obsolescence. When you're ready to expand, it will be too.

Lightning Fast VESA Local Bus IDE Controller

Provides 32-bit wide path that runs at the speed of the CPU. Achieve a maximum transfer rate of 132MB/sec.

"True Color" Video—Up To 16.7 Million Colors

With the FLEX VESA Local Bus card by BOCA, the barriers are down! Our "True Color" video provides VESA standard 72Hz maximum refresh rate and support for up to 16.7 million colors at 640 x 480 resolution.

32-Bit Power Plus VESA Speed

Window Accelerator from BOCA with "True Color" Video

The FLEXVISION Monitor by Mag

VESA Standard 72Hz Refresh Rate for "Flicker Free" Images

You won't find a better value in a 14" SVGA non-interlaced monitor. Manufactured for USA FLEX by MAG InnoVision—whose monitors have won the prestigious PC Magazine Editor's Choice award in each of the last two years. The FLEXVISION provides sharp flicker-free images at even the highest resolutions.

PC MAGAZINE EDITORS' CHOICE July 1991 MAG MK10W

PC MAGAZINE EDITORS' CHOICE June 1992 MAG MK11W

All FLEX VESA Local Bus Systems Come With:

- 64K Ultra-fast "Writeback" Cache Memory
- Upgradeable to Intel OverDrive™ Processors
- 170 MB < 13ms Hard Disk Drive with built-in 32K Cache
- VESA 32-Bit Local Bus IDE Controller
- 4 MB RAM expandable to 32 MB
- Super VGA 1024 X 768 FLEXVISION 14" .28 mm Non-Interlaced Monitor by MAG
- 32-Bit VESA Local Bus Card with 16.7 million "True Color"
- 1.2 MB and 1.44 MB Floppy Disk Drives
- 101 Key "Space Saving" Keyboard
- 2 Serial and 1 Parallel Port
- Highest Quality Desktop Cabinet
- Dos 5.0, Windows 3.1 and Mouse
- Free Windows Application Software

Choose Your Speed!

FLEX VL486SX 25MHz VESA Local BUS
Intel486™ SX 25MHz Microprocessor with 170MB Hard Drive **$1499**
Lease from $57/Month*

FLEX VL486DX 33MHz VESA Local BUS
Intel486 DX 33MHz Microprocessor with 170MB Hard Drive **$1799**
Lease from $67/Month*

FLEX VL486DX2 50MHz VESA Local BUS
Intel486 DX2 50MHz Microprocessor with 170MB Hard Drive **$1949**
Lease from $73/Month*

FLEX VL486DX2 66MHz VESA Local BUS
Intel486 DX2 66MHz Microprocessor with 170MB Hard Drive **$2199**
Lease from $82/Month*

210MB and 340MB Hard Drives Available. Call for Pricing!

TO ORDER, CALL...

USA FLEX 1-800-333-4515

FEDERAL EXPRESS

OPEN 24 HOURS MONDAY THRU FRIDAY SAT & SUN 9 AM to 6 PM

6 VESA Systems!

170MB of Peak Performance From Western Digital

The 170MB drive standard in your FLEX VL486 system is from Western Digital, one of the leading names in hard disk drives. Advanced features as CacheFlow, Hyperseek and DMA Data Transfer, enable you to take full advantage of the faster throughput of your high-speed FLEX Vesa system.

Whisper Quiet Floppy Drives From Sony

Sony is the manufacturer of choice for the floppy drives included as standard in our FLEX systems. With over ten years of experience in the floppy disk drive industry, Sony continues to lead the field with innovative features such as a unique anti-dust structure and low power consumption.

Case Designed Specially For High Speed 486

The FLEX case is more than just a "pretty face". Features like a clip-on front bezel make installation, access and maintenance a breeze. And if expansion capabilities are a concern, rest easy. With a total of seven drive bays, you can be sure that this case will grow with you. Top it off with a 200 watt power supply that's UL approved and you've got one of the most versatile cases in the industry.

Classic Touch and Ergonomic Design

We've matched our FLEX system up with the BEST from the industry's leader in keyboard design... IBM by Lexmark. Once you experience the classic touch and feel of our keyboard, you'll never want another.

And Last But Not Least...The Flex Mouse

Offering up to 1450 dpi and "Dynamic Tracking", resolution is automatically adjusted according to the speed of your hand for effortless operation.

"Extras" At No Charge

All FLEX Systems Come With:

- Microsoft DOS 5.0, Microsoft Windows and Mouse
- 30 Day "NO RISK" Money Back Guarantee
- One Year Parts and Labor Warranty
- 24 Hour Toll-Free Technical Support, 7 DAYS A WEEK!
- Overnight Parts Replacement via Federal Express
- On-Site Service Should an Unusual Problem Occur
- Bulletin Board Technical Support

Free Software!

Buy any FLEX system shown in our ad and get one of these COMPUTER ASSOCIATES Windows software packages absolutely FREE! (Includes installation)

- Cricket Paint-Image Processing
- RET™/Xbase-Report Writing
- Textor-Word Processing
- Compete!-Spreadsheet
- UpToDate-Resource Mgmt.
- dBFast-Database

COMPUTER ASSOCIATES

Super Fast, Super Price! The FLEX *Advantage* 486SLC2

At the heart of the FLEX *Advantage* system is a unique motherboard manufactured by **IBM** for USA FLEX. By combining the IBM 486SLC2 chip with Paradise accelerated on-board video, the FLEX *Advantage* provides high performance and speed at an unbelievably low cost.

Paradise Windows Accelerated On-Board Video

By integrating the Paradise WD90C31 accelerated video chip on the motherboard, we've cut the cost of our FLEX *Advantage* system without sacrificing one ounce of performance. It features 16-bit "true-color", resolution up to 1280 x 1024, 1 MB of display RAM and 16 million WinMarks.

The FLEX *Advantage* System 486SLC2 50/25MHz

- 486SLC2 50/25MHz Microprocessor, 16K Internal Cache
- 105 MB < 16ms Hard Drive
- 4 MB RAM up to 32 MB
- 14", .28mm, Non-Interlaced, 1024 x 768, SVGA FLEXVISION Monitor by Mag
- Paradise WD90C31 Windows Accelerator Video Chip
- 3.5" 1.44MB Floppy Disk Drive
- 101 Key Keyboard
- 2 Serial and 1 Parallel Port
- Dos 5.0, Windows 3.1 and Mouse
- Free Windows Application Software

For Only...

$1499

With 210MB Hard Drive $1649

VESA Local Bus For Under $1,000!

Get Started For Only...

$999

intel inside

- Upgradeable Intel® 486 SX-25MHz Processor
- 80MB Hard Disk Drive
- 2 MB RAM expandable to 32 MB
- SVGA Card with 1024 x 768 Max. Resolution
- 14" SVGA Color Monitor
- 1.44 MB Floppy Disk Drive
- 101 Key Keyboard
- Two 5.25" Drive Bays for Easy Upgrading
- Space Saving Mini Tower Case
- DOS 5.0

FAX (708) 351-7204
Gov't & Education Sales 1-800-395-7025
Gov't & Education FAX (708) 351-9871
Habla Espanol 1-800-723-5500 • (708) 924-6780
Pour les Francophones 1-800-723-2256 • (708) 582-6179

FLEXFAX Automated Fax Retrieval System

FLEXFAX (708) 351-5419

- Details/specs on products
- Technical support/helpful Hints
- Monthly Specials
- "Like new" demo stock
- Inventory clearance items

All products or services are identified by the trademarks or service marks of their respective companies. Specific software documentation may differ from that illustrated. All prices and specifications are subject to change without notice. Shipping and handling charges additional. 30 day money back guarantee applies to Flex systems only. Downloaded and opened software is not refundable. * Monthly payment based on 36 month open end lease. The Intel Logo and OverDrive are registered trademarks of Intel Corporation.

Code # PM03B3

CIRCLE 189 ON READER SERVICE CARD

USA FLEX... FOR SOLUTIONS THAT

MONITOR BUNDLE SPECIAL

MAG INNOVISION

15" MAG Monitor and ATI Video Card Bundle

MAG InnoVision's 15" MX15F Multi-frequency Color Monitor **$849** *MAG-MX15F & ATI-ULTRA-1*

- 1280 x 1024 Non-interlaced
- Flat Square Tube with INVAR shadow mask and non-glare etched screen
- .28mm Dot Pitch

ATI Graphics ULTRA

- 1 MB VRAM • OEM box and manual

MONITORS

Panasonic Office Automation

14" C1381I .28mm, 1024 X 768 Int. **$329**
14" C1395 .28mm, 1024 X 768 NI **$429**

SAMSUNG

12" Amber Mono 720 X 350 ..... **$79**
14" CVL4955 .41mm, 640 X 480 ..... **$219**
14" SM 2 .39mm, 1024 X 768 Int. **$249**
14" SM 3 .28mm, 1024 X 768 Int **$299**
14" SM 3n .28mm, 1024 X 768 NI **$339**
15" SM 15 .28mm, 1024 X 768 NI **$479**
17" SM 4 .31mm, 1024 X 768 NI **$799**
17" SM 5 .26mm, 1280 x 1024 ..... **$899**

NEC *With AccuColor Control

14" 2A .31mm, 800 X 600 ..... **$399**
15" 3FGx .28mm, 1024 X 768 NI **$609**
15" 4FG* .28mm, 1024 X 768 NI **$709**
17" 5FG* .28mm, 1280 X 1024 NI **$1249**
21" 6FG* .28mm, 1280 X 1024 NI **$2299**

CTX *Microprocessor based

14" 5439-A .39mm, 1024 X 768 Int. **$229**
14" 5468 .28mm, 1024 X 768 Int. **$274**
14" CPS 1461 .28mm, 1024 X 768 NI, VESA standards **$309**
15" CPS 1560* .28mm, 1024 X 768 NI **$459**
17" 1760 Proscan*
.28mm, 1280 X 1024 NI **$829**

MAG INNOVISION **Microprocessor based Monitors**

15" MX15F .28mm, 1280 X 1024 NI ... **$569**
15" MX17F .26mm, 1280 X 1024 NI . **$1049**

SONY

14" CPD-1320 .25mm, 640 X 480 ..... **$339**
14" CPD-1304 .25mm, 1024 X 768 NI . **$569**
17" CPD-1604S .25mm, 1024X768 NI **$1049**

MATH COPROCESSORS

intel

80287-XL 8, 10, 16, 20 MHz..... **$85**
80387-SX 16, 20, 25 MHz **$79**
80387-SL 16, 20, 25 MHz **$79**
80387-DX 16, 20, 25, 33 MHz . **$85**
80487-SX 20, 25 MHz **$449**

INTEGRATED INFORMATION TECHNOLOGY, INC.

3C87SX-20 MHz **$69** **3C87-25 MHz** **$79**
3C87SX-25 MHz **$75** **3C87-33 MHz** **$79**
3C87SX-33 MHz **$75** **3C87-40 MHz** **$89**

SOUND CARDS

Sound Blaster 1.5 *D1-BLASTER* **$95**
Sound Blaster PRO Basic *D1-BLASTER-PB* **$145**
Sound Blaster PRO *D1-BLASTER-P* **$185**
Sound Blaster 16 *D1-BLAST16* **$239**

US ROBOTICS MODEMS

Sportster 9600 FAX (int) **$269** US Robotics
Sportster 9600 Fax (ext) **$289**
Sportster 14.4 Fax (int) **$299**
Sportster 14.4 Fax (ext) **$319**
World Port 14.4 V.42 bis Fax (ext) **$399**
Courier V.32bis Fax (int) **$399**
Courier V.32bis Fax (ext) **$439**

VIDEO CARDS

DIAMOND

Stealth PRO - 1MB VGA
D1-DSTPRO1 ..... **$249**
Stealth PRO - 2MB VGA
D1-DSTPRO2 ..... **$359**
Stealth 24 - 1MB VGA
D1-DST24/1 ..... **$169**
SpeedStar 24X - 1MB VGA
D1-DSS/24X **$159**

PARADISE Western Digital Imaging

16-Bit SVGA Windows Accelerator Board 1MB
D1-PARADISE **$149**

ORCHID

ProDesigner II/s - 1MB **$149**
Farenheit 1280 - 1MB **$199**
FarenheitVA - 1MB **$219**

ATi

VGABASIC - 16™ **$59**
STEREO•FX™ **$109**
VGASTEREO•F/X - 1MB **$219**
GRAPHIC SOLUTIONS **$45**
GRAPHICS VANTAGE - 1MB **$215**
8514•ULTRA - 1MB **$275**
GRAPHICS ULTRA™ - 1MB **$299**
GRAPHICS ULTRA - 2MB. **$339**
GRAPHICS ULTRA PRO - 2MB. **$519**

MODEMS

Hayes

OPTIMA 24/SC EZ *125488* **$129**
OPTIMA 24 + FAX96 *125475* **$149**
OPTIMA 96 + FAX96 *125479* **$379**
OPTIMA™ 144+ FAX144 *125478* **$469**
SMARTCOM EXEC *200024* **$69**
POCKET EDITION™ 2400 *125450* **$119**

PRACTICAL PERIPHERALS

2400 BPS Pocket FAX Modem Send/rec.
PM2400FPPM **$109**
2400 BPS Stand Alone & Internal Modem
SA *PM2400EFXSA* **$139**
INT *PM2400EFX* **$129**
9600 BPS V.32 Stand Alone & PM9600FX INT.
SA *PM9600FXMT* **$229**
INT *PM9600FX* **$199**

***the ultimate* MODEM by FLEX!**
V.32bis 14.4 Internal modem with group 3 send/receive fax, V.42 bis and MNP5 data comp. **Free Quick Link II software** **$189**

MicroSolutions BACKPACK EXT. DRIVES

Plug 'N Play - No Slot Drives
Floppy Drive 3.5" 1.44 MB *D1-BP1.44* **$199**
Floppy Drive 5.25" 1.2 MB *D1-BP1.2* **$199**
Floppy Drives require DOS 2.0 or above
Tape Drive
80/250 MB w/Data Comp. *D1-BP80/TD* .. **$429**
Hard Drive 40 MB *D1-BP40HD* **$419**
Hard Drive 100 MB *D1-BP100/HD* **$499**
Hard Drive 200 MB *D1-BP200/HD* **$639**
Tape and Hard Drives require DOS 3.0 or above

DRIVES

Seagate

HARD DRIVES
ST351A/X 42.8/80MB*, IDE **$154**
ST3120A 106.9MB, 15ms, IDE **$245**
ST3144A 130MB, 16ms, IDE **$269**
ST3283A 245MB, 12ms, IDE **$539**
ST1480A 426MB, 14ms, IDE **$829**
ST3283N 248MB, 12ms, SCSI **$569**
ST1401N 338MB, 12ms,SCSI **$999**
ST1480N 426MB, 14ms, SCSI **$1049**
BOCA IDE Floppy Controller **$29**
Adaptec SCSI Host adapter kit **$139**
with Corel SCSI software **$199**
Sold only with the purchase of a hard drive.
Cable and frame kit sold separately.
*80MB w/ AddStor data compression software.

PRINTERS

IBM® LASER PRINTERS BY LEXMARK™

LaserPrinter E - 5 ppm, 10 fonts, 512K, 300 dpi *4019E01* **$749**
LaserPrinter - 10 ppm, 10 fonts, 512K, 300 dpi *4019001* **$1189**
LaserPrinter 5E - 5 ppm, 26 fonts, 1MB, 300 dpi *4029010* **$919**
LaserPrinter 6 - 6 ppm, 27 fonts, 1MB, 300 dpi* *4029020* **$1189**
LaserPrinter 6A (MAC) - 6 ppm, 39 fonts, 2MB, 300 dpi* *4029021* **$1529**
LaserPrinter 6P (MAC) - 6 ppm, 27 fonts, 2MB, 300 dpi* *4029022* **$1359**
LaserPrinter 10 - 10 ppm, 27 fonts, 1MB, 300 dpi* *4029030* **$1259**
LaserPrinter 10L - 10 ppm, 27 fonts, 1MB, 300 dpi* *4029040* **$1499**
LaserPrinter 10A - 10 ppm, 39 fonts, 5MB, 600 dpi *4029041* **$1959**
LaserPrinter 10P - 10 ppm, 39 fonts, 5MB, 600 dpi *4029042* **$1749**
*Exp. up to 600 dpi with the addition of 5MB + PostScript.

IBM DOT MATRIX PRINTERS BY LEXMARK™

Model 2380 - N-carr., 240 X 144 dpi, 320 cps, 65-NLQ, 4 fonts *2380001* **$329**
Model 2381 - W-carr., 240 X 144 dpi, 320 cps, 65-NLQ, 4 fonts *2381001* **$459**
Model 2390 - N-carr., 360 dpi, 200 cps, 60-LQ, 8 fonts *2390001* **$329**
Model 2391 - W-carr., 360 dpi, 200 cps, 60-LQ, 8 fonts *2391001* **$459**

IBM PORTABLE PRINTERS BY LEXMARK™

2.5 lbs. with battery, 360 dpi, battery operated, 53 LQ, 1 year Lexmark™ Express Service
Black *5183010* or White *5183020* **$349**

EPSON **LASER PRINTERS**

ACTION LASER 1000 - 6 ppm, 14 fonts, 300 dpi, 512K.. **$649**
ACTION LASER 1500 - 6 ppm, 14 fonts & 13 scalable 300 dpi, 512K **$799**
ACTION LASER II - 6 ppm, 14 fonts, 300 dpi, 512K **$699**
EPL-8000 - 10 ppm, 14 fonts, 300 dpi, 1MB **$1069**
EPL-7500 PS - LIMITED QUANTITY
6 ppm, 35 fonts, 300 dpi, 512K **$799**

EPSON **DOT MATRIX PRINTERS**

AP 2250 N-carr., 240 X 144 dpi, 3 fonts **$119**
LX-810 N-carr., 240 X 216 dpi, 3 fonts.. **$169**
AP 3250 N-carr., 360 dpi, 6 fonts **$189**
FX-870 N-carr., 240 X 216 dpi, 4 fonts . **$269**
FX-1170 W-carr., 240 X 216 dpi, 4 fonts **$359**
LQ-570 N-carr., 360 dpi, 12 fonts **$244**
LQ-1070 W-carr., 360 dpi, 12 fonts **$359**
LQ-870 N-carr., 360 dpi, 12 fonts **$429**
LQ-860 Color N-carr., 360 dpi, 4 fonts .. **$554**
LQ-1170 W-carr., 360 dpi, 12 fonts **$589**
LQ-2550 Color W-carr., 360 dpi, 8 fonts **$869**
DFX-5000 W-carr., 240 X 216 dpi, 533* cps, 80-NLQ, 3 fonts **$1,269**
DFX-8000 same as DFX-5000 with 1066* cps and 192-NLQ **$2,139**
*Super draft mode

Dataproducts **LASER PRINTERS**

LZR 960 PostScript, 9 ppm, 2 MB, 35 fonts, 300 dpi **$1399**
LZR 965 PostScript, 9 ppm, 35 PostScript & 6 PCL fonts, 8MB, 300/600 dpi **$2399**
LZR 1560 PostScript, 15 ppm, 35 fonts, 11 x 17, 4 MB, 300/400 dpi **$2999**
LZR 1555 15 ppm, 13 scalable & 14 bitmap fonts, 11 x 17, 4 MB, 300/400 dpi.... **$2999**

DATAPRODUCTS DOT MATRIX PRINTERS

LX 455™ 33-pin, up to 750 LPM, 6 fonts **$3699**

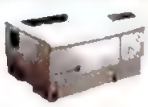
star MICRONICS **DOT MATRIX PRINTERS**

NX-1040 Rainbow - **$159**
NX-2430 Multi-Font - **$229**
Starjet SJ-48 Inkjet Printer - **$285**
NX-2420 Rainbow - **$279**

ARE MORE THAN JUST SYSTEMS!

Huge Discounts on Manufacturer's Reconditioned Monitors and Printers from Epson, NEC, and Panasonic.
Ask your sales representative for pricing and availability.

PRINTERS



NEC LASER PRINTERS

Silentwriter Model 95FX* - PostScript printer, 6 ppm, 35 scalable Adobe fonts, 14 bitmap fonts, 8 scalable HP fonts, 300 dpi, 2MB and built in env. feeder, Built-in send & rec. fax cap. **$1849**

Silentwriter Model 95* **$1359**

Silentwriter Model 97* Same as model 95 accept with: 10 ppm, Built in 10 envelope feeder, Accepts Model 9510 fax bit **$1689**

Silentwriter Model 97FX* Same as model 97 upgraded with built-in plain paper send/receive fax capability. **$2169**

Special 3 Year On-site Limited Warranty!
Hurry, offer ends March 31, 1993

Silentwriter Model 990 - *NEW LOW PRICE*
PostScript printer, RISC processor, max. 8 ppm, 35 scalable Adobe fonts, 14 bitmap fonts, 300 dpi, 2MB and 200 sht. letter cass . **$1199**

Canon BUBBLE JET PORTABLE PRINTERS

BJ-5 360 dpi, 37K, 6 fonts, 142 cps **$199**
BJ-10ex 360 dpi, 37K, 6 fonts, 142 cps **$249**
BJ-200 360 dpi, 49K, 9 fonts, 248 cps .. **$329**
BJ-20 360 dpi, 37K, 7 fonts, 188 cps, plus auto sheet feeder **$369**
BJ-300/330 360 dpi, 30K, 3 fonts, 600 cps BJ-300 (narcarr.) **$329** BJ-330 (wide-carr.) **$559**
BJC-800/820 Color Prints 11 x 17, 360 dpi, 7K, built-in auto sheet feeder, 600 cps
BJC-800 (parallel interface) **$1799**
BJC-820 (scsi interface) **$1929**

Canon LASER BEAM PRINTERS

LBP-4SX 4 ppm, 300 dpi, 1 MB, 4 scalable typefaces & 3 bitmap fonts, 70 sht. multi-purpose paper tray, 26 lbs. **$899**
LBP-8SX 8 ppm, 300 dpi, 1 MB, 3 scalable typefaces & 3 bitmap fonts, 200 sht. letter cass., 44 lbs. **$1299**

Panasonic LASER PRINTERS

KX-P4410 - 5 ppm, 28 fonts, 300 dpi, 512K **$619**
KX-P4430 - 5 ppm, 28 fonts, 300 dpi, 1MB **$859**
KX-P4450i - 11 ppm, 28 fonts, 512K... **$1069**
KX-P4451 - 11 ppm, 28 fonts, 1MB **$1369**
KX-P4455 PS - 11 ppm, 39 fonts, 512K **$1679**

Panasonic DOT MATRIX PRINTERS

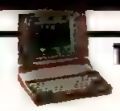
KX-P1180i N-carr., 240x216 dpi, 6 fonts **$149**
KX-P2180 N-carr., 240x216 dpi, 9 fonts **$159**
KX-P1123 N-carr., 360 dpi, 7 fonts **$194**
KX-P2123 N-carr., 360 dpi, 10 fonts **$234**
KX-P1124i N-carr., 360 dpi, 10 fonts **$275**
KX-P2124 N-carr., 360 dpi, 12 fonts **$305**
KX-P1624 W-carr., 360 dpi, 7 fonts **$329**
KX-P1695 W-carr., 240x216 dpi, 8 fonts **$354**
KX-P1654 W-carr., 360 dpi, 10 fonts **$514**
KX-P2624 W-carr., 360 dpi, 11 fonts **$359**

NOVELL

NOVELL NETWORKING SOFTWARE

Netware V2.2 5-User 3.5" *588381* **$539**
Netware V2.2 10-User 3.5" *588383* **$1189**
Netware V3.11 5-User 3.5" *588323* **$629**
Netware V3.11 5-User 3.5" *588299* **$1429**
Netware V3.11 20-User 3.5" *588311* **$1999**
Netware V3.11 50-User 3.5" *588327* **$2849**
Netware V3.11 100-User 3.5" *588333* . **$3999**
Netware Lite V1.1 Win or DOS V6.0 *270704* **$89**
Netware Lite V1.1 Starter Kits 3.5" *583055* **$399**
Netware Lite Add- on kit *583060* **$209**

TOSHIBA LAPTOPS



MICROSOFT MS-DOS 5.0
Included on all systems

T1800 20MHz i386SX, 60MB **$1049**
80MB **$1199**
80MB with Windows & Trackball **$1298**
T1850 25MHz i386SX, 80MB/120MB ..... **$1449/$1658**
T1850C 25MHz i386SX, 80MB/120MB ..... **$2099/$2319**
T3300SL 25MHz i386SL, 120MB **$2129**
T4400SX 25MHz i486SX, 120MB **$2389**
T4400C 25MHz i486DX, 120MB **$3389**
T4400C 25MHz i486DX, 200MB **$4089**
T4500 20MHz i486SX 80MB/120MB ..... **$2369/$2549**
T4500C 20MHz i486SX,120MB **$3729**
T6400DX* 33MHz i486DX, 200MB **$3899**
T6400DXC* 33MHz i486DX, 200MB **$5849**
*(AC Power Only)

CD ROM DRIVES

SONY

Desktop Library™ CD-ROM Kits
Complete Kits include:
- CD\ROM Drive with 550 MS Access Time
- 16-Bit Sound Board • Sony Speakers
- Plus 6 popular CD\ROM Software Titles
- 1 Year Limited Warranty

Complete External *CDU-7305* **$849**
Complete Internal *CDU-31A-LL/L* **$649**
Int. CD\ROM Starter Kit *CDU-31A-LL/L* ..... * **$399**
*Starter kit includes 3 popular CD titles & does not include sound card or speakers

SONY

INTERNAL & EXTERNAL
MPC standards, 340ms, dust proof construction, built-in audio, layered error correction code, includes Sony interface card
Internal *D1-CD535 & D1-OPA461* **$345**
External *D1-CD7201 & D1-OPA462* **$479**

MITSUMI INTERNAL
350ms, 16-bit bus interface card, controller card, cable & device driver, multi-media supported, audio playback, dust proof patented. **Internal** *D1-LU005* **$199**

NEC INTERNAL & EXTERNAL

280ms access time, 300KB/second data tranfer rate, MPC compliant, 2 year warranty, 64K cache, AT interface card
Internal *D1-CDR-84 & CD-XT003* **$609**
External *D1-CDR-74 & CD-XT003* **$679**
External *D1-CDR73M-XT* **$549**

CD/ROM SOFTWARE SPECIAL

Buy any Sony, NEC or Mitsumi CD ROM drive listed above and receive any CD titles listed through FLEXFAX at a special package price. If you already own a CD ROM drive you may purchase these titles at a low discount prices.

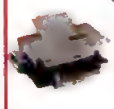
HEWLETT PACKARD HP FAX MACHINES & ACCESSORIES

HP FAX-200 Plain-paper, cut sheet printing, 12 page memory **$959**
HP FAX-310 Plain-paper, cut sheet printing, 28 page memory **$1129***

*Includes mail-in rebate of **$150** rebate offer for HP FAX-310. Offer ends 2/28/93

Black Toner Cartridge	Quantity 1-3	4+
LaserJet II, IID, III IIID *92295A*	$79	$76
LaserJet IIP & IIIP *92275A*	$61	$59
LaserJet *92285A*	$82	$79
LaserJet IIISi *92291A*	$119	$115

FLEXfax NEW FLEXFAX Automated Fax Retrieval System



- Details/specs on products
- Technical support helpful hints.
- Monthly Specials
- "Like New" Demo Stock
- Inventory Clearance items

FLEXFAX # (708) 351-5419
24 hours a day, 7 days a week.

COMPAQ

COMPAQ ProLinea 3/25s 84MB *141650-006* **$919**
*84MB Bundle *141650-004* **$999**
120MB *141650-007* **$979**
*120MB Bundle *141650-005* **$1079**
COMPAQ ProLinea 4/25s 240MB *143200-009* **$1399**
*Bundle *143200-007* **$1479**
COMPAQ ProLinea 4/50 120MB *146000-008* **$1839**
*120MB Bundle *146000-006* **$1949**
COMPAQ DESKPRO 3/25i 84MB *141000-407* **$1689**
120MB *141000-403* **$1689**
COMPAQ DESKPRO 3/33i 84MB *141100-407* **$1689**
120MB *141100-408* **$1779**
COMPAQ Contura 3/20 84MB *139600-006* **$1299**
COMPAQ Contura 3/25 84MB *139400-009* **$1599**
120MB *139400-006* **$1799**
COMPAQ Contura 3/25c 84MB *139410-004* **$2099**
120MB *139410-005* **$2299**
COMPAQ LTE Lite/25c 84MB *138250-003* **$3299**
120MB *138250-004* **$3599**
COMPAQ DESKPRO 386/20e 386DX, 20 MHz, 110 MB W/Samsung SyncMaster 2 ..... **$1299**
W/Samsung SyncMaster 3 ..... **$1349**
*Ask your sales rep. for details.

TAPE BACK UP

COLORADO MEMORY SYSTEMS INC.

JUMBO 120 - 120MB storage capacity
INT. *D1-JUMBO* **$178**
EXT. *D1-JUMBO & D1-KE-10* **$285**

JUMBO 250 - 250MB storage capacity
INT. *D1-DJ-20* **$234**
EXT. *D1-DJ-20 & D1-KE-10* **$347**

JUMBO TRAKKER™ - Plug and play, no hardware to install. Works with any computer with an IBM® parallel printer port.
120MB *D1-JT10* **$339**..... 250MB *D1-JT20* **$399**

NEW POWERTAPE™ -
2 GB Int. *D1-PT-25* / **Ext.** *D1-PTE-25* ..... **CALL**
4 GBint. *D1-PT-50* / **Ext.** *D1-PTE-50* ..... **CALL**
CM 2.4 GB Cartridge *5-DT-2400* **$45**
CM 4 GB Cartridge *5-DT-4000* **$49**

3M DATA CARTRIDGES

DC2000-40/80MB **$16.99**
Form. **$18.95**
DC2080-80/160MB **$21.95**
Form **$24.95**
DC2060-60MB Form **$25.95**
DC2120-120/250MB **$23.95** ..... Form. **$26.95**
DC600A **$20.49**
DC300XLP **$18.69**
DC6150-250/500MB **$21.49**
DC6250-250/500MB **$25.49**
DC6525-350/700MB **$32.95**

USA FLEX

TO ORDER **1-800-766-1940**
FAX # (708) 351-7204
Government/Ed. Sales 1-800-395-7025
Government/Ed. FAX (708) 351-9871
Habla Espanol 1-800-723-5500/(708) 924-6780
Pour Les Francophones
1-800-723-2256/(708) 582-6179
Code # PM03B3

OPEN 24 HOURS MONDAY THRU FRIDAY

Minimum Order $80. MasterCard, Visa, Discover and Flex Cards accepted for sales in continental USA, Alaska, Hawaii and FPO. [A $10.00 surcharge on credit card order for FPO] Leasing available for qualified businesses. Shipping and handling additional. Corporations rated 2A1 or better and government accepted for Net 30 basis with receipt of a purchase order. C.O.D. order under $500.00 add $5.00, over $500.00 add $10.00 check warranty charge. Call for special UPS Red and UPS Blue C.O.D. rates. Call for PAL rates. AK, HI, Puerto Rico, APO and FPO add 5% to cover additional shipping and handling costs. All returns must have prior authorization from our Customer Service Department. (708) 351-7172. All returns must be in original packaging and include all warranty cards and manuals. Incomplete product, returns, unauthorized returns and refused shipments are subject to a 20% restocking charge. All prices and specifications are subject to change without notice. $11.95 minimum shipping and handling. IBM is a registered trademark of International Business Machines Corporation and used under license. Lexmark is a trademark of Lexmark International, Inc. Please refer to code numbers when placing an order.

CIRCLE 210 ON READER SERVICE CARD

USA FLEX • 471 Brighton Drive, Bloomingdale, IL 60108

work in text mode, the principles remain the same for working in graphics mode.

The first routine is a short BASIC program that uses BASIC's DEF SEG, PEEK, and POKE commands to access video memory. The PEEK command can be used to read a byte from memory. The POKE command allows a BASIC program to write a byte directly to memory.

The problem with both the PEEK and POKE commands is that they only accept an offset to an address instead of a segment and offset. The reason for this lies in the history of Microsoft BASIC. Since the original Microsoft BASIC was designed for 8-bit machines such as the Altair, the Apple II, and the Commodore PET, the POKE command only needed to write to an address of 0 to 65,535.

In 1981, Microsoft needed to rewrite its BASIC to work with the segmented architecture of the Intel 8088 used in the IBM PC. Instead of redesigning every command that accessed memory, Microsoft added the DEF SEG command that set the DEFault SEGment that would be used for memory accesses. This addition allowed users of the earlier Microsoft BASIC to port their old programs with a minimum of trouble. It also kept the syntax of the IBM PC version of Microsoft BASIC similar to that of BASIC interpreters on other types of computers that didn't need to deal with Intel's segmented architecture.

The BASIC program FTR.BAS, shown in Figure 3, moves an image resembling an Imperial Fighter (from the movie *Star Wars*) across the screen. FTR takes the steps that are necessary for any PC-based program that directly accesses video memory. The screen mode must be either determined or set, the location of the video buffer must be determined, and the screen must be initialized. Once all this has been done, the data can be written directly to the video RAM.

FTR uses BASIC's SCREEN statement to set the video mode. The line `SCREEN Ø` sets it to text mode.

The location of the video buffer is determined by calling the routine GetVidBuff. This routine first uses the DEF SEG statement to set the default segment to 40h, which is the BIOS data segment. The PEEK command is then used to look at offset 63h in the BIOS data segment to get the starting address of the video controller registers. If the address of the video controller is 3D4h, the screen is operating in color mode and the segment of the video buffer is B800h. If the address is 3B4h, the screen is operating in monochrome mode and the segment is B000h. The starting offset of the video buffer is stored in offset 43h of the BIOS data segment.

Drawing the fighter is simply a matter of POKEing the proper values into the character bytes in the video buffer. FTR uses three characters to draw the fighter, two graphic line characters to draw the wings, and a capital O to draw the fuselage. When the fighter is moved, the image of the fighter is erased by POKEing spaces in the memory locations where the fighter characters were and POKEing the new fighter in the new location.

Figure 4 shows FTR.C, which does the same thing as the BASIC program FTR.BAS. (You can download both files from the Programming Forum on PC MagNet archived as FTR.ZIP.) While the same tasks are performed by both, there are noteworthy differences between the C code and the BASIC code. The library functions _setvideomode and _clearscreen perform the same duties as the SCREEN and CLS statements in the BASIC code.

The routine GetVideoBuff does the same job GetVidBuff did in the BASIC program: It determines the segment and offset of the active video buffer. (Actually, since the video mode is set to a color text mode with the _setvideomode call, we know that the buffer is at B800:0 hex, but the function is provided for comparison with the BASIC code.)

GetVideoBuff accesses the BIOS data segment just as the BASIC version did, by checking the address of the video

FTR.BAS
Complete Listing

```
'-----------------------------------------------
' FTR.BAS - A video demonstration program
'
' Copyright 1993 Douglas Boling
'-----------------------------------------------
GOSUB GetVidBuff
SCREEN 0, 0, 0, 0:  'Set text video mode
CLS :               'Clear the screen
DEF SEG = vidseg:   'Point to video segment
k = vidoff:         'Point to starting off
'Display fighter and loop
FOR i = 0 TO 24 STEP 4
   FOR j = i * 2 TO 158 - (i * 2) STEP 2
      GOSUB eraseship
      k = j + (i * 160)
      GOSUB drawship
      FOR m = 1 TO 255:  'Delay
      NEXT m
   NEXT j

   FOR j = 158 - (i * 2) TO i * 2 STEP -2
      GOSUB eraseship
      k = j + ((i + 2) * 160)
      GOSUB drawship
      FOR m = 1 TO 255:  'Delay
      NEXT m
   NEXT j
NEXT i
END
'
' Determine video buffer location
'
GetVidBuff:
DEF SEG = &H40
IF ((PEEK(&H63) AND &H40) = &H40) THEN
   vidseg = &HB800
ELSE
   vidseg = &HB000
END IF
vidoff = PEEK(&H44)
vidoff = (vidoff * 256) + PEEK(&H43)
RETURN
'
'Draw spaceship using text characters
'
DrawShip:
POKE k, 199
POKE k + 2, 79
POKE k + 4, 182
RETURN
'
'Erase space ship using blanks
'
EraseShip:
POKE k, 32
POKE k + 2, 32
POKE k + 4, 32
RETURN
badvideo:
PRINT "Video Error"
RESUME NEXT
```

***Figure 3:* A BASIC program that writes directly to video memory.**

Introducing

The Best Notebook Value in the USA

33Mhz 386sx

Complete Notebook Package Only

$999.00

60 MB Hard Drive

From the company that brought you the best Values in 486 computers comes the **Most Powerful** 386sx Notebook at the **Most Affordable Price**. Today you can have the power of a desktop computer in an energy efficient, lightweight, compact package. Plus, an easy to read 640x480 VGA screen with 64 levels of grey and 60 Meg fast Hard Drive means you'll be able to keep working while other laptops slow their users to an unproductive halt. Compare the Expo Tech Value ... **Then Buy the Best with Expo Tech.**

- 33 MHz 80386sx CPU
- 60 MB Hard Drive
- 2 MB RAM
- 1 Parallel, 2 Serial Ports
- MS DOS 5.0
- Super Fast VGA Graphics
- 64 gray scale color emulation
- External Monitor & Keyboard Ports
- Only 2.1"(H)x11.4"(W)x9.25"(D)
- Weighs Less than 7 lbs.

Expo Tech

113 McHenry Rd. Buffalo Grove, IL 60089
Phone (800) 284-3976 • Fax (800) 947-3976

1-800-284-EXPO

All Prices, Availability and Specifications subject to change without notice. Please call to confirm Pricing, IL. Sales Tax, Availability, and Warranty Details.

Expo Tech Com

NEW 210Mb Hard Drive

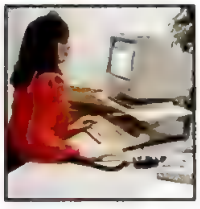
A New Level of 486 intel inside Value!

When one of the largest computer manufacturers in the world with over $700 million in sales and 5000 employees wanted to bring out a new computer line, we asked thousands of business users, home professionals, engineers, and novices what they wanted in a computer. We were told "the most power, the highest resolution monitor, the largest hard drive, complete software, an in house service department, security from viruses- all at the lowest price!" This was a tall order. But, after extensive research and testing, we finally met the challenge. Thus, the EXPO Tech computer was born. With everything from high resolution monitors to a built-in modem for remote diagnostics, EXPO Tech computers are the new definition of computer excellence. Furthermore, we have dedicated over 100 people to help you get the most from your computer.

At EXPO Tech, we are dedicated to providing our customers with a new level of quality...

RESEARCH AND DEVELOPMENT

Most computer companies buy different parts from many different manufacturers and then assemble their computers. At EXPO Tech computers we have our own research and development laboratories and manufacture the motherboards ourselves. Thus, you can be assured of consistent superior quality, compatibility, and always being on the leading edge of computer power and value. While most companies are introducing yesterdays technology, at EXPO Tech computers we will always give you Tomorrow's technology TODAY.



REMOTE DIAGNOSTICS

As computers and software change we at EXPO Tech computers realize our customers will need help with their future system configurations. Every EXPO Tech computer is equipped with a modem and special software that will let us access your computer, diagnose the hardware problem, and tell you how to solve the situation. All from the comfort of your own telephone!! Plus, we have a staff of certified technicians ready to talk you through your situation, and a 24 hr tele-tech service to help you every hour of the day or night. Furthermore, you can download drivers and other helpful software from our bulletin board service. At EXPO Tech computers, we want you to be secure and problem free today and tomorrow.

EXHAUSTIVE PRODUCT TESTING All EXPO Tech components are tested for 24 hrs before they are assembled and then the completed EXPO Tech computer is burned-in again before shipping. We are so sure you will love your EXPO Tech computer that we will give you a full 30 day money back guarantee.

The EXPO Tech 486sx/33

- Desktop Metal Case, 33 Mhz
- 1 Mb super VGA Video Board w/Windows Accelerator and displays 16.7 Million colors
- 1.2 Meg Floppy, 1.44 Meg Floppy
- 102 Key Keyboard
- 14"Super VGA .28 Non Interlaced Monitor
- Multi I/O (2 Serial, 1 Parallel, 1 Game Port)
- MS-DOS 5.0, Windows 3.1, Hi-Res Mouse
- Commute Remote Diagnostic Software
- Central Point Anti-Virus Software
- 2400 Baud Modem w/Send-Receive Fax
- 4 Mb RAM, 210 Meg Seagate Hard Drive

33Mhz $1299

Redefining Value

486dx2/50 Mhz

Same Configuration as above
Plus 128 K Cache

Just $1749

puters

The EXPO Tech 486/33

- Desktop Metal Case, 128 K Cache, 33 Mhz
- 1 Mb super VGA Video Board w/Windows Accelerator and displays 16.7 Million colors
- 1.2 Meg Floppy, 1.44 Meg Floppy
- 102 Key Keyboard
- 14"Super VGA .28 Non Interlaced Monitor
- Multi I/O (2 Serial, 1 Parallel, 1 Game Port)
- MS-DOS 5.0, Windows 3.1, Hi-Res Mouse
- Commute Remote Diagnostic Software
- Central Point Anti-Virus Software
- 2400 Baud Modem w/Send-Receive Fax
- 4 Mb RAM, 210 Meg Seagate Hard Drive

Just $1599

on the Desktop!

486dx2/66 Mhz

Same Configuration as above

Just $1999

Tower System SHown is Optional

A New Level of Service and Support!

- **24 HOUR TECH SUPPORT**
  Toll Free Technical Support Available 24 Hrs a day 7 days a week.
- **REMOTE DIAGNOSTICS**
  On- Site Modem Diagnostics .
- **ANTI-VIRUS SOFTWARE**
  Central Point Anti-Virus Software included.
- **SAME DAY SHIPPING**
  Base System models in stock ordered before 11am CST, Can be shipped same day after Credit approval.
- **ONE YEAR ON-SITE SERVICE**
  Have your computer repaired at your site.
- **NEXT DAY PARTS REPLACEMENT**
  Replacement parts sent 24 Hour Express.
- **30 DAY NO RISK GUARANTEE**
  Full refund if you are not satisfied in the first 30 days after shipment.
- **BUILT-IN 2400 BAUD MODEM**
  2400/9600 Send Recieve Fax Modem Included with every EXPO Tech Desktop System.
- **FREE MICROSOFT WORKS**
  Wordprocessor, Spreadsheet, Database, Graphics for Windows.
- **BULLETIN BOARD SERVICE**
  Download Drivers and talk to techs on line.
- **NO SURCHARGE ON CREDIT CARDS**
  We accept Visa and Mastercard.
- **LEASING AVAILABLE**
  Leasing available to qualified buyers.
- **PURCHASE ORDERS ACCEPTED**
  COD and terms for qualified customers.
- **OPEN 7 DAYS A WEEK**
  8am-8pm M-F, 10am-6pm Sat. 11am-3pm Sun.
  All Times are Central Standard Times.

1-800-284-EXPO

intel inside Expo Tech intel inside

113 McHenry Rd. Buffalo Grove, IL 60089
Phone (800) 284-3976 • Fax (800) 947-3976

Software, Modem, & Service Package for Desktop & Tower Systems Only. All Prices, Availability and Specifications subject to change without notice. Please call to confirm Pricing, IL. SalesTax,Availability, and Warranty Details.
The Intel Inside Logo is a trademark of Intel Corporation.

CIRCLE 305 ON READER SERVICE CARD

FTR.C

Complete Listing

```
//-----------------------------------------------------------------
// FTR.C - A video demonstration program
//
// Copyright 1993 Douglas Boling
//-----------------------------------------------------------------

#include <bios.h>
#include <graph.h>

void DrawShip (int);
void EraseShip (int);
void GetVideoBuff (void);

unsigned int usVSeg, usVOff;

main () {
   unsigned far * lptr;
   int     i, j, k, m;

   _setvideomode (_TEXTC80);              // Set video mode
   _clearscreen (_GCLEARSCREEN);          // Clear screen

   GetVideoBuff();
   // Display fighter and loop
   k = 0;
   for (i = 0; i < 25; i += 4) {
      for (j = i * 2; j < 150 - (i * 2); j += 2) {
         EraseShip(k);
         k = j + (i * 160);
         DrawShip (k);
         for (m = 0; m < 32384; m++);
      }
      for (j = 150 - (i * 2); j > (i * 2); j -= 2) {
         EraseShip(k);
         k = j + ((i + 2) * 160);
         DrawShip (k);
         for (m = 0; m < 32384; m++);
      }
   }
   return 0;
}
//
// Determine video buffer location
//
void GetVideoBuff (void) {
   lptr = 0x400063;                       // Get video segment
   if ((*lptr && 0x400) == 0)
      usVSeg = 0xb000;
   else
      usVSeg = 0xb800;

   lptr = 0x40004e;                       // Get video buff offset
   usVOff = *lptr;
   return;
}
//
// Draw spaceship using text characters
//
void DrawShip (int sOffset) {
   char far *lpBuff;

   lpBuff = (((long) usVSeg) << 16) | sOffset;
   *lpBuff = 199;
   lpBuff += 2;
   *lpBuff = 79;
   lpBuff += 2;
   *lpBuff = 182;
   return;
}
//
// Erase space ship using blanks
//
void EraseShip (int sOffset) {
   char _far *lpBuff;

   lpBuff = (((long) usVSeg) << 16) | sOffset;
   *lpBuff = 32;
   lpBuff +=2;
   *lpBuff = 32;
   lpBuff +=2;
   *lpBuff = 32;
   return;
}
```

Figure 4: **A C program that writes directly to video memory.**

controller. In the case of the C code, reading memory is simply a matter of loading a pointer with the proper segment and offset and reading the value it points to. In this case, the data is read and tested to determine whether the video is using the color or monochrome address space for the video buffer.

The `for` loops that cause the fighter to zigzag back and forth across the screen perform the same function as the ones in the BASIC program. Just as in the BASIC program, the fighter is drawn by writing directly to the video memory. As with accessing the BIOS data segment, accessing the video memory in C is a matter of using a pointer to the proper memory address.

The two programs provide an interesting contrast. BASIC is simple and easy to learn and use, but direct accesses to memory are a two-step process involving the DEF SEG and PEEK or POKE commands.

Accessing memory in C is simpler, since it only involves using a pointer to the proper address. Because pointers are an integral part of the C language, the full power of the language can be brought to bear on the memory address in question. Logical and arithmetic operations can be performed directly on the video memory data. In BASIC, the memory must be read using PEEK, modified and then written back with POKE.

Whatever language is used, accessing video memory will always be a staple of DOS programs that need blazing speed.—*Douglas Boling*

Vertical Applications

HOTEL/MOTEL MANAGEMENT SOFTWARE

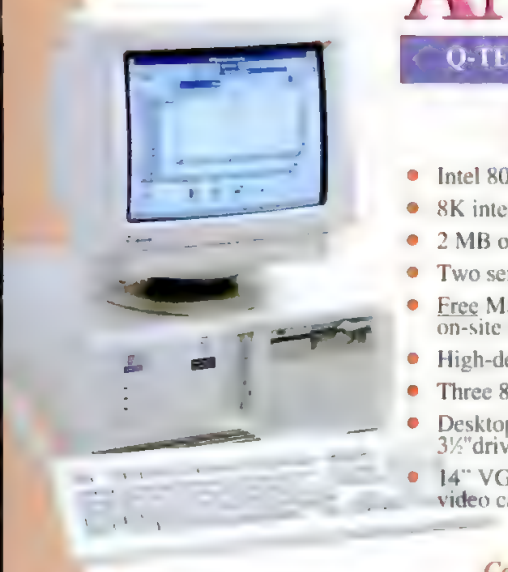
❓ I have recently become involved in the operation of a 36-room hotel, and crave a software package that would make its operation easier. I have tried the only software I could find here, and it was a little like using a sophisticated accounting package just to balance a checkbook. My operation is small and seasonal, but it does involve reservations and cancellations from groups of people, many of them requesting a particular room.

I would be most grateful if you could suggest some suitable software.

Randy McCoy
Queensland, Australia

▶**PC MAGAZINE:** My search for hotel and motel reservation and management software turned up a wide variety of packages, ranging in price from about $500 to over $20,000. Hotel management is a very specialized field, and all the packages come from value-added resellers (VARs) or consultants. Because of this, the majority of packages handle more than just reservations, and include such features as accounting functions, room service management, and housekeeping. Most also have options to interface with telephone-call billing systems or in-room movie systems. Since you've said that yours is a smaller hotel, I've limited the packages to those that primarily handle

Q-Tech. The best PC values ANYWHERE!



Q-TECH 486SX-25 INCLUDES:

$1099 PLUS SHPG

- Intel 80486SX 25 MHz microprocessor
- 8K internal RAM cache
- 2 MB of 70ns RAM, 80 MB IDE hard drive
- Two serial ports and 1 parallel port
- Free MS-DOS 5.0 and one year on-site service
- High-density 5¼" or 3½" floppy drive
- Three 8-bit and five 16-bit expansion slots
- Desktop chassis with three 5¼" and two 3½"drive bays
- 14" VGA color monitor and 16-bit video card

Call Us About Our 486SX-25 Performance Pack System $1399

Q-TECH 486DX-33 INCLUDES:

$1499 PLUS SHPG

- Intel 80486DX 33 MHz microprocessor
- 8K internal, 128K external RAM cache
- 2 MB of 70ns RAM, 80 MB IDE hard drive
- Two serial ports and 1 parallel port
- Free MS-DOS 5.0 and one year on-site service
- High-density 5¼" or 3½" floppy drive
- Two 8-bit and six 16-bit expansion slots-tower chassis optional
- Desktop chassis with three 5¼" and two 3½"drive bays
- 14" VGA color monitor and 16-bit video card

Call Us About Our 486DX-33 Performance Pack System $1799

intel inside

Q-TECH 486DX-50 INCLUDES:

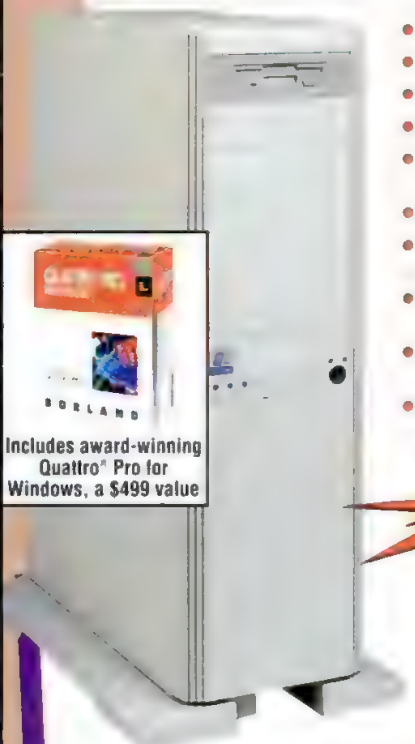
$2199 PLUS SHPG

- Intel 80486DX 50 MHz microprocessor
- 256K external RAM cache
- 4 MB of 70ns RAM, 80 MB IDE hard drive
- Two serial ports and 1 parallel port
- Free MS-DOS 5.0, Windows 3.1, a mouse, and one year on-site service
- High-density 5¼" and 3½" floppy drives
- Two 8-bit and six 16-bit expansion slots-tower chassis optional
- Desktop chassis with three 5¼" and two 3½"drive bays
- .28 mm dot pitch NI SVGA color monitor and 1 MB VGA video card
- Quattro® Pro for DOS or Windows included

Q-TECH 486DX2-66 INCLUDES:

$2299 PLUS SHPG

- Intel 80486DX2 66 MHz microprocessor
- 8K internal, 256K external RAM cache
- 4 MB of 70ns RAM, 80 MB IDE hard drive
- Two serial ports and 1 parallel port
- Free MS-DOS 5.0, Windows 3.1, a mouse, and one year on-site service
- High-density 5¼" and 3½" floppy drives
- Two 8-bit and six 16-bit expansion slots-tower chassis optional
- Desktop chassis with three 5¼" and two 3½"drive bays
- .28 mm dot pitch NI SVGA color monitor and 1 MB VGA video card
- Quattro® Pro for DOS or Windows included



Includes award-winning Quattro® Pro for Windows, a $499 value

Tower chassis available for $100 additional

PLUS! THE BEST SERVICE ANYWHERE!

- **Lowest prices everyday and payment options including leasing.**
- **Stock systems ship same day. Overnight, second day available.**
- **Custom configurations ship in 48 hours.**
- **Lifetime tech support and one year service on-site FREE!**
- **30-day satisfaction guaranteed.**
- **Exclusive software value packs- A $710 value for just $99. Call us today!**

VISA

LeaseCard

AUTHORIZED Q-TECH DEALERSHIPS AVAILABLE.
Call (708) 634-6650 and ask for the Dealer Desk.

Please refer to ad code #428 when you call.

708-634-6650

QUILL®

Quill Corporation
100 Schelter Road
Lincolnshire, IL 60069-3621

COMPAQ

IF YOU'RE BUYING COMPAQ, BUY SMART. BUY DIRECT. BUY PCs COMPLEAT.

☑ DOES COMPAQ TOP YOUR SYSTEMS SHOPPING LIST?

Put PCs Compleat up there too. Because we now sell – direct – a full line of COMPAQ computers. From high-performance COMPAQ notebooks and small office machines to powerful custom-configured systems. All with the same compleat service and guaranteed lowest prices you've come to expect from us.

☑ THE MOST COMPLEAT VALUE WITH GUARANTEED LOWEST PRICES.

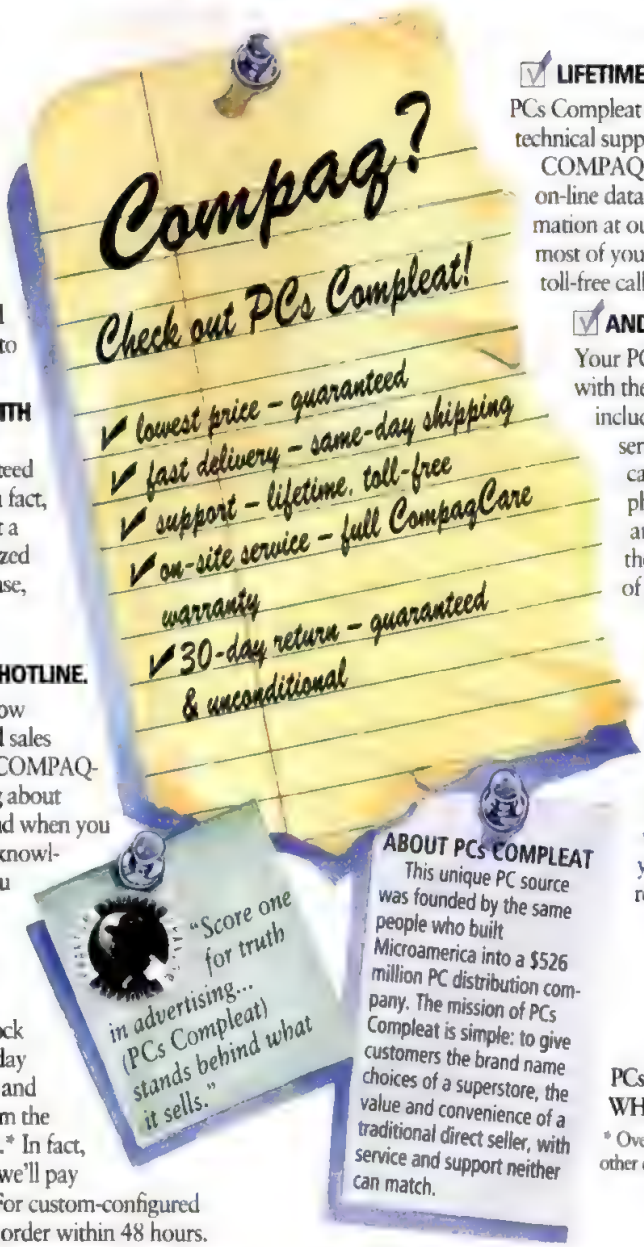
PCs Compleat offers you the guaranteed lowest price for COMPAQ systems. In fact, if you find a readily-available system at a lower price from a COMPAQ-authorized supplier within 30 days of your purchase, we'll promptly refund the difference.

☑ DEDICATED COMPAQ SALES CONSULTANTS AND TOLL-FREE HOTLINE.

We don't just sell COMPAQ, we know COMPAQ! Our COMPAQ-dedicated sales consultants are COMPAQ-trained and COMPAQ-knowledgeable. They know everything about COMPAQ that you need to know. And when you call 1-800-377-4727, they'll put their knowledge to work for you to ensure that you get what you need.

☑ CALL OUR COMPAQ HOTLINE TODAY... HAVE YOUR COMPAQ TOMORROW.

Place your order for a standard in-stock configuration by 4:00 p.m. EST, Monday through Friday, and we'll have you up and running on your new COMPAQ system the next morning, using overnight delivery.* In fact, we guarantee to ship the same day, or we'll pay your shipping and insurance charges! For custom-configured COMPAQs, we'll build and ship your order within 48 hours.



☑ LIFETIME, TOLL-FREE SUPPORT.

PCs Compleat is there with toll-free, technical support for the life of your COMPAQ. At no additional cost. Our on-line database puts customer service information at our expert technicians' fingertips, so most of your questions can be answered in one toll-free call.

☑ AND COMPLEAT ON-SITE SERVICE.

Your PCs Compleat COMPAQ comes with the full manufacturer's warranty, including CompaqCare on-site service. Under your warranty, if we cannot fix your problem over the phone, we'll contact a local, authorized technician to correct the problem at your site – free of charge.

☑ BUY DIRECT – RISK-FREE.

How? With our 30-day unconditional, money-back guarantee. If you're not compleatly satisfied with any PC system you purchase from PC Compleat – for any reason – within 30 days, we will promptly replace it or refund your money. And there's no restocking fee.

PCs COMPLEAT.
WHY SHOP AROUND ANYMORE?

* Overnight delivery costs are slightly higher than other delivery options.

GUARANTEED LOWEST PC PRICES • BRAND NAMES YOU TRUST • IMMEDIATE AVAILABILITY • UNMATCHED SERVICE

WE WON'T ACCEPT ANYTHING LESS THAN YOUR COMPLEAT SATISFACTION. SO WHY SHOULD YOU?

At PCs Compleat, system selection, purchase, and delivery are fast and efficient. Our order entry system knows the COMPAQ-compatible options, peripherals, and accessories necessary to build your custom-configured system.

So, minutes after your phone order is entered, we have the compleat list of items and instructions to build your COMPAQ, load your software, test and ship. When your COMPAQ arrives, you simply plug and play.

PCs COMPLEAT HAS WHAT YOU NEED. BRAND NAMES AT THE LOWEST PRICE–DIRECT.

We've added this outstanding line of COMPAQs to the over 1,000 brand name systems, software, and peripherals we already stock. That means no more long lead times or backorders. Just fast, same-day service and shipping.

Of course, we'll also custom configure to your specifications. And if you're not sure what they are – but you know what you need to get done – we can even help you spec the system that's just right for your needs and budget. All at no cost to you.

WE EVEN MAKE IT EASY TO PAY...

You can pay for your order with most major credit cards. We add no surcharges, and your card is not charged until your order is shipped. We also accept company or personal checks, money orders, wire transfers, CODs, APOs, FPOs, and purchase orders.

CIRCLE 268 ON READER SERVICE CARD

Contura 25MHz 386SL

- 4MB RAM, expandable to 12MB
- 64KB cache
- 120MB hard drive
- Weight 6.2lbs
- MS-DOS 5.0, Windows 3.1, PFS: Window Works
- Compaq trackball

Call for pricing on other models

$1749
Lease for $64.18/month

Contura 25MHz 386SL Color

- 4MB RAM, expandable to 12MB
- 64KB cache
- 84MB hard drive
- Weight 6.7lbs
- MS-DOS 5.0, Windows 3.1
- Compaq trackball

$2079

- 120MB hard drive configuration

$2269

Call for pricing on other models

$2079
Lease for $76.29/month

LTE Lite 25MHz 386SL Color

- 4MB RAM, expandable to 20MB
- 64KB cache, 84MB hard drive
- Active matrix color display
- Weight 6.5lbs
- MS-DOS 5.0, Windows 3.1
- Built-in Easy Point 6trackball

$3299

- 120MB configuration

$3589

Call for pricing on other models

$3299
Lease for $121.07/month

ProLinea 486 Desktops

- MS-DOS 5.0, Windows 3.1 and mouse
- W+ models include PFS Window Works, Modem, Prodigy, 5.25" floppy.

Processor/ Model	120MB Drive	240MB Drive
486SX25	$1199	$1399
486DX2/50	$1839	$1999
486DX2/50W+	$1959	$2119

Compaq SVGA monitor $349.99
Call for pricing on other models

$1199
Lease for $59/month

90 DAYS FREE FINANCING TO QUALIFIED INDIVIDUALS!

PCs Compleat can also extend to you a new and unique line of credit, the PCs Compleat Technology Card. You can use your Technology Card like any credit card for all of your PCs Compleat purchases, and there's no application fee and no annual fee.

INTRODUCE YOURSELF TO THE PCs COMPLEAT TECHNOLOGY CARD WITH OUR 90 DAYS FREE FINANCING OFFER!!

For a limited time, as a special get-acquainted offer, any PCs Compleat purchase you charge to your Technology Card and pay in full within 90 days of the purchase, will be interest-free. Limited time offer.

AND OUR LOW-COST LEASING PLAN FOR QUALIFIED BUSINESSES.

PCs Compleat also extends a low-cost leasing option with 100% financing for up to 60 months. All costs are covered – including software, peripherals, and accessories. Talk with a PCs Compleat consultant today for compleat details.

CORPORATE CUSTOMERS.

Ask about our Volume Purchase Agreements (VPA) and Asset Tagging Program.

PCs COMPLEAT

Real Service • Unreal Prices

1-800-377-4727

CALL THE PCs COMPLEAT COMPAQ HOTLINE

HOURS:
Mon.-Fri. 9 a.m.- 9 p.m. EST
Sat. 10 a.m.- 6 p.m. EST
Sun. 12 p.m.- 6 p.m. EST
24-HOUR FAX ORDERS:
1-800-669-8329
INTERNATIONAL CALLS:
1-508-624-6400

PCM-3/93BCOM

©PCs COMPLEAT. 495 Technology Center West, 34 St. Martin Drive, Marlborough, MA 01752. All prices are subject to change and do not include shipping. COMPAQ is a trademark of Compaq Computer Corporation.

GUARANTEED LOWEST PC PRICES • BRAND NAMES YOU TRUST • IMMEDIATE AVAILABILITY • UNMATCHED SERVICE

The most compleat PC value, with guaranteed lowest prices.

PCs Compleat offers you low PC prices we guarantee nobody can beat. But what makes us totally unique is the brand selection, service and support you receive. From custom configured "plug and play" systems and overnight delivery to flexible leasing plans and free lifetime technical support, we're the most compleat PC source ever.

GUARANTEED LOWEST PRICE ON EVERY PC.

You always get the lowest available price on PCs Compleat systems. In fact, if you find a readily available system at a lower price from any authorized supplier within 30 days of your purchase, we'll promptly refund the difference.

SYSTEMS CONFIGURED WITH EVERYTHING YOU NEED.

Let PCs Compleat put your entire system together and eliminate installation hassles. We'll install extra memory, modem and network cards, disk and tape drives—even configure your printer driver—at no charge. Just take your PC out of the box, plug it in, and go to work!

GUARANTEED OVERNIGHT DELIVERY AVAILABLE ON OVER 50 STANDARD SYSTEMS.

PCs Compleat can have you up and running on your new system by tomorrow morning, using overnight delivery.* If your order for a standard, in-stock configuration is received by 4:00 p.m. EST Monday through Friday, we guarantee to ship it that day—or we'll pay your delivery and insurance charges.

30-DAY RISK-FREE GUARANTEE.

You must be compleatly satisfied with your PCs Compleat system. If not, simply return it within 30 days of purchase, and we'll promptly replace it or give you a full refund. Your choice.

90 DAYS FREE FINANCING TO QUALIFIED INDIVIDUALS

PCs Compleat can also extend to you a new and unique line of credit, the PCs Compleat Technology Card. You can use your Technology Card for all your PCs Compleat purchases, and there's no application fee and no annual fee. And for a limited time, as a special get acquainted offer, any PCs Compleat purchase you charge to your Technology Card and pay in full within 90 days of the purchase will be interest-free.**

SOFTWARE INSTALLED FREE OF CHARGE

Avoid the hassle of installing software by having us do it for you. PCs Compleat offers a broad selection of application software at low prices. Ask our sales consultants about spectacular savings available from PCs Compleat's Software On Systems (SOS) menu.

OVER 1000 BRAND NAME PRODUCTS

PCs Compleat is your super direct source for a comprehensive selection of hardware, software, peripherals, and accessories at super low prices. You get the convenience of one call shopping for all your computing needs.

48-HOUR DELIVERY ON CUSTOM CONFIGURATIONS.

Using PCs Compleat's state-of-the-art order entry system and overnight delivery—most custom configured systems are delivered to your door within 48 hours.

FREE LIFETIME TOLL-FREE TECHNICAL SUPPORT.

After your system arrives, PCs Compleat's professionals are ready to assist you with any technical issues. Most technical questions can be answered in just one toll-free call. This free technical support is available for as long as you own your PCs Compleat system.

FREE ON-SITE SERVICE.

Every PCs Compleat system comes with the manufacturer's full warranty, including on-site service (when applicable). Under the warranty, if you have a problem PCs Compleat can't fix over the phone, we'll immediately dispatch a technician to your office—at no charge.

LOW-COST LEASING PLANS.

With PCs Compleat, approved accounts have the option of leasing with 100% financing for up to 60 months. Leasing covers all equipment costs, including peripherals, software, and accessories. Terms are very reasonable. Phone for compleat details.

IT'S EASY TO ORDER.

Call PCs Compleat for a free consultation, or to order. You can also fax your order, toll-free, 24 hours a day. We welcome most major credit cards, approved company or personal checks, money orders, wire transfers, CODs, APOs, FPOs, purchase orders—and leases. Corporate customers—ask about our Asset Tagging Program and Volume Purchase Agreement (VPA).

*Overnight delivery costs slightly more than other delivery options. **Subject to credit approval by Monogram Credit Card Bank of Georgia. Except in CO, IA, ME, NC and WI, finance charges will be assessed at a variable monthly periodic rate that is based on a corresponding variable annual percentage rate equal to the greater of (A) **21.84% ANNUAL PERCENTAGE RATE** and (B) the sum of (i) the prime rate as published in The Wall Street Journal in its "Money Rates" section on the last business day of each calendar month, plus (ii) **13.34%**, in each case, subject to a minimum **FINANCE CHARGE of $.50** (except in certain states.) Under this formula, as of July 31, 1992, the monthly periodic rate was **1.82%** and the corresponding **ANNUAL PERCENTAGE RATE was 21.84%**. In CO, IA, ME, NC and WI the monthly periodic rate will be 1.5%, which is a corresponding **ANNUAL PERCENTAGE RATE of 18%**. If purchases are paid-in-full within 90 days of the purchase date, the account will be credited for all finance charges and insurance charges that accrued on such purchases during such period. Thereafter, finance charges will continue at the applicable rate noted above.

COMPAQ products now available

Call for pricing.

COMPAQ

ProLinea 25MHz Desktops
- Includes MS-DOS 5.0, Windows 3.1, and COMPAQ mouse

Processor	Hard Drive	System Only	w/Monitor
386SX25	80MB	$1099	$1299
386SX25	120MB	$979	$1329
486SX25	120MB	$1199	$1549
486SX25	240MB	$1399	$1749

Lease for $50/mo.

$899

AST

Bravo
- 4MB RAM
- 120MB hard drive
- MS-DOS, Windows 3.1, Mouse

Processor	System Only	AST SVGA Monitor
486SX25	$1049	$1459
486DX33	$1459	$1819
486DX2/50	$1869	$2269
486DX2/66	$2179	$2539

Lease for $50/mo.

$1049

LEADING EDGE

486 Systems
- 1.44MB and 1.2MB floppy drives
- Local bus slot, 1MB video RAM

Processor	Drive	Desktop	Minitower
SX25	107MB	$1069	$1139
SX33	130MB	$1259	$1299
DX33	130MB	$1519	$1599
DX33	214MB	$1649	$1729
DX2/50	214MB	$1799	$1879
DX2/66	214MB	$2099	$2149

Color VGA monitors start at $229.99

Lease for $50/mo.

$1069

COMPAQ

ProLinea 486DX2/50
- 4 MB RAM
- MS-DOS 5.0, Windows 3.1, Mouse

"W+" models also include PFS: Windows Works, 5.25" drive, Modem, Prodigy

Processor/Model	Hard Drive	Price
486DX2/50	120MB	$1839
486DX2/50W+	120MB	$1959
486DX2/50	240MB	$1999
486DX2/50W+	240MB	$2119

Lease for $67.49/mo.

$1839

TOSHIBA

T1800SX 386SX20
- 2MB RAM, 60MB hard drive

$1089

T4500
- 4MB RAM, 120 MB hard drive

$2669

T4400C 486SX25
- 4MB RAM, 120MB hard drive

$3549

Lease for $50/mo.

$1089

COMPAQ

Contura 3/25
- Trackball
- MS-DOS, Windows 3.1

Display	Hard drive	Price
Mono	120MB	$1749
Color	80MB	$2079
Color	120MB	$2269

T TL Lite/25C

Display	Hard drive	Price
Color	80MB	$3299
Color	120MB	$3589

Lease for $64.18/mo.

$1749

TEXAS INSTRUMENTS

TravelMate 4000
- 4MB RAM
- MS-DOS 5.0, Windows 3.1

Processor	Display	Hard Drive	Price
486SX/25	Mono	120MB	$2399
486SX/25	Color	120MB	$3239
486DX/25	Mono	120MB	$2829
486DX/25	Mono	200MB	$3149
486DX2/50	Mono	200MB	$3399
486DX2/40	Color	200MB	$3939

Lease for $88.04/mo.

$2399

AST

Power Exec
- 4MB RAM
- Windows 3.1
- Trackball, 2 PCMCIA slots

Processor	Hard drive	Price
386SL25 Mono	120MB	$2399
386SL25 Passive Color	160MB	$3499
386SL25 Active Color	200MB	$3799
486SL25 Mono	200MB	$2949
486SL25 Passive Color	200MB	$3649
486SL25 Active Color	200MB	$4449

Lease for $91.71/mo.

$2499

TOLL-FREE SALES
1-800-669-4727

COMPAQ HOTLINE
1-800-697-4727

Sales Hours: Monday-Friday 9a.m.-9 p.m. EST; Saturday 10 a.m.-6 p.m.; Sunday, Noon-6 p.m.

PCs COMPLEAT

Real Service ◆ Unreal Prices

PCs COMPLEAT. All prices are subject to change, and do not include shipping. When you call PCs COMPLEAT, you'll always get the best available price. Lease prices reflect 36 month operating lease to approved business customers. Monitors are sold separately. COMPAQ is a registered trademark of Compaq Computer Corporation. AST and AST logo are registered trademarks of AST Research, Inc. Leading Edge is a trademark of Daewoo Telecom Corporation. WINSX is a trademark of Tecmar International, Inc. Toshiba is a trademark of Toshiba America Information Systems, Inc. MS-DOS and Windows are trademarks of Microsoft Corporation. All other products or brand names are trademarks of their respective companies.

PCM-3/93B

CIRCLE 092 ON READER SERVICE CARD

Let Mitac Put
NOVELL-CERTIFIED 486-66 EISA
The Perfect Server
FEATURES
♦ Built-In Co-Processor
♦ Shared Memory
♦ 256K Of Writeback Cache
♦ Open System Architecture
♦ Multi-Layered Security System
♦ Power to Spare
SPECIFICATIONS
♦ Intel™ 486DX2-66MHz Processor
♦ 8MB 70ns RAM
♦ TEAC 1.2MB or 1.44MB Floppy Drive
♦ Conner 540MB SCSI Drive
♦ EISA SCSI Controller
♦ Integrated VGA
♦ MS-DOS 5.0, Windows 3.1, Mouse
♦ 101 Enhanced Keyboard
♦ 14" Mono VGA Monitor
♦ 2 Serial & 1 Parallel Port
$3975
33MHz Model Also Available
NetWare Integrated
The Only Red You'll Ever See!
MITAC

Out Your Networking Fires!

TIRED OF NETWORK FIREFIGHTING?

Most people think that putting out fires is *de rigueur* when doing networks. Well, at Mitac Networks Direct *(formerly AGATech)*, we make sure that it doesn't have to be that way. That's why, in addition to building all of our ready-to-use networks with the best components and peripherals available, we've put together our comprehensive *Mitac Network-Ready Program*. A revolutionary concept in customer support that assists you from the moment you call about your new Mitac network.

The Mitac Network-Ready Program

- ♦ CUSTOM NETWORK CONFIGURATION
- ♦ NOVELL-CERTIFIED ENGINEERS & SYSTEMS
- ♦ FULL LINE OF NETWORK CABLING & PERIPHERALS
- ♦ EXPERT INSTALLATION
- ♦ SUPERIOR HANDS-ON NETWORK TRAINING
  LANS, UNIX, TCP/IP, NFS, WAN & NETWORK MGMT
- ♦ LIFETIME TOLL-FREE TECHNICAL SUPPORT
- ♦ 1-YEAR PARTS & LABOR WARRANTY
- ♦ 30-DAY NO-RISK MONEY BACK GUARANTEE
- ♦ ON-SITE DOW JONES SERVICE

NETWORKS YOU CAN COUNT ON!

With over a $1/2-billion in annual sales, complete systems solutions sold in over 50 countries worldwide and a dedicated work force of over 1,100 employees, Mitac provides you with technological excellence that ensures that you're getting the best. We give you the latest high-performance systems, fully-tested and custom-configured for today's needs and tomorrow's challenges, and sell direct to you at the best prices possible. It's simple. At Mitac, you won't get hosed.

intel inside

TRUE INVESTMENT PROTECTION!

QUALITY MANUFACTURING

All of our American-made systems are designed and built according to rigid quality control standards, assuring that you get consistent and unparalleled performance.

QUALITY COMPONENTS & PERIPHERALS

Only the finest components available qualify to become integral parts of your Mitac system or network. Recognized leaders like 3-Com, Conner, Diamond, Intel, Maxtor, Microdyne, Micropolis, Motorola Altair, Novell, SCO, SynOptics, TEAC, US Robotics and Xircom are just some of the members of the growing Mitac Network team.

CUTTING EDGE TECHNOLOGY

Our engineers go out of their way to keep Mitac systems and networks on the cutting edge of technology. You can bet that if there is a new, proven advancement in computing or network communication technology, Mitac will deliver it!

CORPORATE & GOVERNMENT ACCOUNTS WELCOME

Our systems and network consultants and engineers work with you to provide you with your best possible solution. We welcome corporate purchase orders and all types of government purchase contracts.

NEW! MULTI-MEDIA KIT $445!

INCLUDES CD ROM, SOUND CARD, 5 TITLES & SPEAKERS

BALLISTIC DESKTOP

- Intel 486DX2-66MHz Processor
- 8 Megabytes - 70ns RAM
- 128K Cache - Expandable to 256K
- TEAC 1.2MB & 1.44MB Floppy Drive
- Conner 540MB 12ms Hard Drive
- IDE Controller with I/O
- Diamond VESA 1MB 24-Bit SVGA
- MS-DOS 5.0, Windows 3.1, Mouse
- 101 Enhanced Keyboard
- 15" Flat Screen SVGA .28 DP Monitor

$3195

LAN MASTER 500

- Intel 486DX-50MHz Processor
- 8 Megabytes - 70ns RAM
- 128K Cache - Expandable to 256K
- TEAC 1.2MB & 1.44MB Floppy Drive
- Conner 340MB 12ms Hard Drive
- IDE Controller with I/O
- Diamond VESA 1MB 24-Bit SVGA
- MS-DOS 5.0, Windows 3.1, Mouse
- 101 Enhanced Keyboard
- 15" Flat Screen SVGA .28 DP Monitor

$2795

VESA STATION

- Intel 486DX-33MHz Processor
- 4 Megabytes - 70ns RAM
- 128K Cache - Expandable to 256K
- TEAC 1.2MB & 1.44MB Floppy Drive
- Conner 170MB 16ms Hard Drive
- IDE Controller with I/O
- Diamond VESA 1MB 24-Bit SVGA
- MS-DOS 5.0, Windows 3.1, Mouse
- 101 Enhanced Keyboard
- 14" SVGA .28 Non-Interlaced Monitor

$1895

THE BOTTOM LINE

- Intel 486SX-25MHz Processor
- 4MB RAM - 8K Cache
- TEAC 1.2MB Floppy Drive & 1.44MB Floppy Drive
- Conner 120MB Hard Drive
- IDE Controller with I/O
- 1MB Super VGA
- MS-DOS 5.0, Windows 3.1, Mouse
- 101 Enhanced Keyboard
- 14" SVGA .28 Non-Interlaced Monitor

$1295

GET THE SAFETY OF MITAC TODAY!

1-800-568-6972

MiTAC

AGATECH NETWORKS DIRECT

48571 Milmont Drive, Bldg B, Fremont, CA 94538
Mon-Fri 6am-6:30pm • Sat 8am-4pm Pacific Time

The Intel Inside Logo is a trademark of Intel Corporation. All other trademarks are owned by their respective companies.
© COPYRIGHT 1993 American Mitac Corporation All prices subject to change without notice

CIRCLE 112 ON READER SERVICE CARD

Since 1982

CompuAbility
Consumer Electronics

800-554-9930
Our 800 Line Now Serves Canada!

or fax us toll free at 800-554-9981

PMG 3-30

PRINTERS

LEXMARK

Laser Printer 6 / 10 ..... $1,189 / $1,259
Laser Printer E / 5E ..... $749 / $919
Laser Printer 6P $1,359
Laser Printer 10L / 10P ..... $1,499 / $1,749
Dot Matrix 2380 / 2381 ..... $325 / $455
Dot Matrix 2390 / 2391 ..... $325 / $455
4079 Thermal Color Jet w/Poscript ... $2,499
4070 Ink Jet/with sheet feeder .. $335 / $375
4226 High Speed Dot Matrix $1,299
Portable, AC adpat., battery, blk or wht $345

EPSON

Action Printer 3250 ..... $189
Action Laser Printer 1000
512K / 2MB $635/709
Action Laser Printer 1500 ..... $779
LX 810 ..... $169
FX 870 / 1050 ..... $269 / $355
FX 1170 ..... $359
LQ 570 / 870 ..... $245 / $425
LQ 1070 / 1170 ..... $355 / $579
LQ 2550 ..... $879
EPL 8000 ..... $1,075
DFX 5000 / 8000 ..... $1,269 / $2,139

Panasonic Office Automation

KX-P 2624 ..... $365
KX-P 2123 / with Color Kit ..... $229/$279
KX-P 2124 / with Color Kit ..... $315/$359

star

NX-1001 Multifont $135
NX-1040 Rainbow NEW $159
NX-2420 Rainbow $269
NX-2430 Black $215
Star Jet 48 ..... $285

NEC

Silentwriter M95, 6ppm Postscript ... $1,399
Silentwriter M95fx (M95 but with fax) . CALL
Silentwriter M97, 10ppm Postscript . $1,769
Silentwriter M97fx (M97 but with fax) CALL

MODEMS

ZOOM

Zoom AMC 2400 Internal with RPI $45
Zoom AMX 2400 External with RPI $59
Zoom AFC 2400 Send96/Rec 48 RPI Int. . $55
Zoom AFX 2400 Send 96/Rec 48 RPI Ext. $69
Zoom FC 2400 Send/Rec 9600 Internal ... $69
Zoom FX 2400 Send/Rec 9600 External ... $89
Zoom 2400 V 42 Send/Rec 9600 with Winfax
FCV Internal / FXV External ..... $115/$125
Zoom V 32 bis Internal/External .... $185/$205
Zoom V 32 bis S/R for Win Int/Ext $199/$239
Zoom V 32 bis Send/Receive 14 400 Int $195
Zoom V 32 bis Send/Receive 14 400 Ext $235
PKT Portable, S/R Fax Modem $85

Supra Corporation

SupraFaxModem Internal 24/96 NEW! $59
Supra 2400 Internal w/ Mirror II $51
Supra 2400 External $69
Supra Fax Modem V.32, Ext. alone $219
SupraFaxModem V.32 bis, Internal
with FaxSoftware DOS/Win .... $199 / $199
SupraFaxModem V 32 bis, Ext alone $279
with Fax Software, DOS $299
with Fax Software for Win $299
with Fax Software for Mac $319

SCANNERS

LOGITECH

Scanman Model 256 (gray scale) $259
Scanman 256 w/Catchword Pro $295
Scanman Color $545
FotoMan ..... Call

ZOOM

Zoom Full Page Scanner, 300 DPI with
Perceive 2.0 OCR for Windows $389

EPSON

EPS 600C Parallel / SCSI ..... $835 / $835
EPS 800C $1,079

MONITORS

Panasonic Office Automation

FACTORY NEW!

Panasync C1381i, .28 DP, 1024 x 768 $309

Pansasync C1395, Non-Interlaced
28 DP, 1024 x 768 ..... $429

CTX

5439A, 14", .39 1024x768, Interlaced .. $245
5468A, 14", 1024x768, Interlaced $275
5468Ni, 14", .28DP, 1024x768,
Non-Interlaced $305
1560, 15", .28DP, 1024 x 768, Noninter $479
1760LC, 17" Flat, .31DP, 1280x1024,
Non-Glare, Non-Interlaced $775

SONY

CPD 1320 UC2, 14", 640 x 480 VGA,
15 MM, Includes Cables & Stand $329
CPD 1304S, 14", 1024 x 768, non-interl
8514A, .25 MM, cables & stand $589
CPD 1604S, 17",1024 x 768, non-interl ,
8514A, .25MM, cables & stand
FREE DELIVERY $1,079

NEC

Multisync 2A, 14" $399
Multisync 3Fgx, 15" $629
Multisync 4Fg, 15" $739
Multisync 5Fg, 17" $1,249

NETWORKING

LANtastic by ARTISOFT

AE/2T Ethernet Adaptor $193
AE-2 Ethernet Starter Kit/Adaptor $445/$193
AE-2 Windows Starter Kit $505
AE-3 ISA Starter Kit/Adaptor ..... $515/$225
AE-3 Windows Starter Kit 515
2 Mbps Starter Kit/Adaptor ..... $319/$128
2 MBPS Windows Starter Kit $385
Z Two Station Kit $81
10 Base/T Starter Kit $579
Peer Hub 10 Base/T Connector $259
Artisoft Central Station $379
Lantastic Voice Adaptor $65
Network Eye $106
Lantastic for Windows/Netware .. $158/$263
AE-2 Ethernet Software $64
Articom / AI V 4 1 ..... $219/$57
NewMedia Kit - FREE DELIVREY $499
EtherBasket (12AE-2 or AE 2T)
FREE DELELIVERY $1,979

3Com

Etherlink II TP, 8 Bit (3C503B-TP) $189
5 Pack, FREE DELIVERY $919
Etherlink II 8 Bit (3C503R) $185
5 Pack, FREE DELIVERY $819
Etherlink II 16 TP 8/16 Bit (3C50-16TP) $179
5 Pack, FREE DELIVERY $739
Etherlink II/16 8/16 (3C503-16) $155
5 Pack, FREE DELIVERY $719
Etherlink 16, 16 Bit (3C507) $275
5 Pack, FREE DELIVERY $1,289
Etherlink 16 TP, 16 Bit (3C507-TP) $295
5 Pack, FREE DELIVERY $1,429
Etherlink III 10BT $129
5 Pack, FREE DELIVERY $599
Etherlink III 5 Pack, FREE DELIVERY $599
Tokenlink III 16/4 Bit ISA FREE DEL. ... $539
Tokenlink III 16/4 Bit EISA, FREE DEL. $729

NOVELL / EAGL • SMC
XIRCOM • GATEWAY • INTEL
THOMAS-CONRAD
Call for Details!

info™
400 DPI Hand Scanner for Windows
with Interpreter Windows OCR Software
$79

HARD DRIVES

Seagate

BEST SELLING HARD DRIVES At Super Sale Prices!

All Seagate Drives Include: Universal Installation Manual, AT Rails & Cable

ST-251-1 MFM	42.8MB	28MS	$239
ST-351A IDE	42MB	28MS	$145
ST-3120A IDE	106.9MB	16MS	$225
ST-3144A IDE	130.7MB	19MS	$229
ST-3243A IDE	214MB	16MS	$345
ST-3283A IDE	245MB	12MS	$389
ST-3283N SCSI	245MB	12MS	$419

Maxtor

IDE 7120 / 7213 ..... $235 / $315
SCSI 7120 / 7213 ..... $239 / $345
IDE 7245 ..... $349
IDE LXT 340 - FREE DELIVERY $649
SCSI LXT 340 - FREE DELIVERY $679
SCSI 540SL - FREE DELIVERY $1,049
SCSI 1240S - FREE DELIVERY $1,849

CONNER
The Storage Answer

NEW DRIVES!

CP3000 / CP60064H IDE ..... $145/$169
CP30084E / CP30104H IDE $189/$235
CP30174E / CP30204 IDE $255/$325
CP30254 IDE $394
CP30080E SCSI $189
CP30100 / CP30170E SCSI $259/$275
CP30200 SCSI $345

QUANTUM

ELS 42 IDE / SCSI ..... $155 / $169
ELS 85 IDE / SCSI ..... $189 / $219
ELS 127 IDE / SCSI ..... $249 / $295
ELS 170 IDE / SCSI ..... $279 / $315
LPS 240 IDE / SCSI ..... $419 / $485
SCSI 425 ProDrive FREE DEL. $919

Plus Development

Hardcard II XL 50 / 105 ..... $199 / $255
Hardcard EZ 42 / 85 ..... $199 / $239
Hardcard EZ 127 / 240 ..... $309 / $519

MICROPOLIS

FREE DELIVERY
In the contiguous 48 states

1528 SCSI	1334MB	FH	$1679
1548 SCSI-2	1748MB	FH	$1879
1568 ESDI	15MHz 676.8 MB	FH	$1299
1588 SCSI	667.8MB	FH	$1349
1598 SCSI-2	1034.5MB	FH	$1399
1624 SCSI-2	668MB	HH	$1199
1664 ESDI	15MHz 345MB	HH	$979
1684 SCSI	340MB	HH	$1059
1908 SCSI-2	1408MB	FH	$1869
1924 SCSI-2	2100MB	FH	$2579
2105 IDE	528MB	FH	$1059
2112A IDE	1050MB	FH	$1539
2112 SCSI-2	1050MB	FH	$1539

FLOPTICAL

SYSGEN

SUPER 21MB External
Includes 8 bit host adapter, software
& five 21MB disketts **$379**

VALUE STOR 21MB Internal
Includes 3.5" drive, 8 bit SCSI host
adapter, cable & software **$309**

REMOVABLE

SyQuest

BARE DRIVE

Syquest 555, 44MB Internal $269
Syquest 5110C, 88MB Internal
(new Reads & Write 44MB & 88MB) $389
Media Cart, 44MB / 88MB $69/99

44MB KITS with interface
8 bit /media cartridge, Int/Ext $359/439

88MB KITS with interface
features Syquest's new 5110C removable cartridge drive - reads & write 44MB & 88MB
8 bit w/media cartridge, Int./Ext. ... $519/599
16 bit w / media cartridge Int./Ext . $599/709

FLOPPY

SONY

FLOPPYDRIVES
3.5" without Frame 1.44MB PC/AT $55

Canon

All Media Floppy
The All-In-One 3.5" & 5.25" Half Height Internal Floppy Drive
$139
Supports 5.25", 360K/1.2MB as well as 3.5", 720KB/1.44MB formats. Any computer with a single 5.25", half height bay can accomodate the AMF. Uses a stantard floppy interface.

TAPE BACK UP

COLORADO MEMORY SYSTEMS INC.

JUMBO - Low Cost Tape Backup
DJ10-120MB $149
Adaptors: AB11 External $37
KE10 External $109
DJ20-250MB $195
Adpators: FC10 Internal $79
KE10 External $109

JUMBO TRAKKER
External Parallel Printer Port Tape Backup System:
JT10(40-120) $335
JT20 (80-250) $395
UNCLUDES: external tape drive, easy-to-use tape backup software, data cable, AC Power adapter and manuals.

POWERTAPE SYSTEM:
4GB of capacity, includes Colorado Backup for DOS software - FREE DELIVERY . $1,549

POWER SUPPLY

TRIPP LITE
THE POWER PEOPLE

BC Series Standby UPS Systems
BC 250: 250 VA, 2 outlet $99
BC 400: 400 VA, 2 outlet $155
BC 500: 500 VA, 4 outlet $179
BC 500LAN: 500 VA, 4 outlet, LAN inter $189
BC 600LAN: 600VA, 4 outlet, LAN inter $245
BC 750LAN: 750 VA, 4 outlet, LAN inter $299
BC 900LAN: 900 VA, 4 outlet, LAN inter $345
BC 1250LAN: 1250 VA, 4 outlet,
2 ms switching, LAN interface $479

Omnipower Line Interactive UPS
- corrects brownouts -
OMNI 450LAN: 450 VA $269
OMNI 600LAN: 600 VA, ... $349
OMNI 750LAN, 750 VA $429
OMNI 900LAN, 900 VA $489
OMNI 1250LAN, 1250 VA $629

APC American Power Conversion

Back Ups
250, LAN nodes, 386SX, 286 systems,
internet hardware , POS $99
400: desktop 386, 486 systems
286 servers $159
450: tower 386, 486 systems, servers . $189
600; heavily configured systems,
CAD/CAM workstations $259
900; multiple systems, longer runtime
applications $369
1250; multiple systems, longer runtime,
telecom , minis $489

Smart Ups
400; 286, 386 desktop syst. & servers $299
600; tower-type servers and engineering
workstations $389
900; CAD/CAM, engineering workstations,
and servers $559
1250; multiple servers,
telecom equipment $729
2000; minicomputers, multiple servers
FREE DELIVERY! $1,299
Powerchute Software for Unix $94

CONTROLLERS

Seagate

ST-01 SCSI 8 Bit Adaptor $29
ST-02 SCSI 8 Bit Adaptor w/FD Control . $45
ST-07 IDE Controller Hard Drive Only $29
ST-08 IDE Controller - HD & Floppy $39
ST-11M MFM 8 Bit Controller $51
ST-11R RLL 8 Bit Controller $51
ST-21M MFM 16 Bit Controller $57
ST-21RL RLL 16 Bit Controller $39
ST-22M MFM 16 Bit-HD & Floppy $67

ADAPTEC

1522 SCSI Direction Kit: 16 Bit Standard
SCSI with Floppy Support & Drivers ... $149
1522 SCSI Direction PLUS Kit $195
1542B SCSI Master Kit: AT to SCSI Bus
Mastering w/Floppy Sup. & Drivers .. $249
1542 SCSI Master PLUS Kit $309

FUTURE DOMAIN

1688: 16 Bit SCSI-2 w/Floppy Support $159
1660 ONK: 16 Bit SCSI-2 without Floppy Support; Includes DOS, Novell, OS/2, Zenix, SCO &CDROM Drivers w/SCSI Cable ... $239

COREL SCSI Software

Allows the connection of up to 7 SCSI peripherals to a single host adapter **$64.95**

VIDEO BOARDS

New Boards!

DIAMOND

SpeedStar 24X, 1Mg, 24bit, 1280x1024 $155
Stealth, 1MG, 32,000 col, 1024x768 .... $215
Stealth 24
ISA / VESA Local Bus ..... $165/$165
Stealth Pro,
SVGA ISA, 1280x1024, 16 color
1MB / 2MB ..... $245/$355
Stealth Pro, VESA local bus
1MB / 2MB ..... $245/$365
Viper VESA Local Bus
1MB / 2MB ..... $315 / $389

ATI Technologies

ATI Graphics plus 1 MB $285
ATI Graphics plus 2 MB $315
ATI Ultra Pro 2 MB $495

SOUND CARDS

CREATIVE
CREATIVE LABS, INC.

New for 93'

Sound Blaster 16 ASP
Upgradable, the New Standard ..... Call!

Sound Blaster Pro Deluxe
Featuring Sound Blaster Pro, Lemmings, Indy 500, Software Toolworks Encyclopedia on CD Rom, & more! $135

Sound Blaster Deluxe
Featuring the Sound Blaster, Lemmings, Indy 500 & more! $89

MORE CARDS!

MS Windows Sound System $175
MS Windows Sound System
with Windows $209
Sound Blaster 16,
PRICE TOO LOW TO ADVERTISE!
Thunderboard / for Win ..... $92 / $105
Pro Audio Spectrum PLUS $135
Pro Audio Spectrum 16 ..... $189
Thunder & Lightning - NEW! $219
Turtle Beach MultiSound Free Del .. $529
UltraSound $129
Logitech SoundMan 16 ..... $175

Our 800 Line Now Serves Canada! 800-554-9930 or fax us toll free at 800-554-9981

Copyrighted mat

Since 1982

ComputAbility Consumer Electronics

800-554-9930

Our 800 Line Now Serves Canada!

or fax us toll free at 800-554-9981

New! CREATIVE New for 93'

CREATIVE LABS, INC.

EDUTAINMENT CD INTERNAL MULTIMEDIA UPGRADE KIT

- Sound Blaster Pro card
- CD ROM Drive (Photo-CD compatible)
- Sound Blaster CT-38 Stereo Speakers
- 10 software titles!

8 bit **CALL!**
16 bit **CALL!**

DISCOVERY CD INTERNAL MULTIMEDIA UPGRADE KIT

- Sound Blaster Pro card
- CD ROM Drive
- Sound Blaster C-38 Stereo Speakers
- 3 software titles!

8 bit **$485**
16 bit **$569**

SOUND BLASTER. CD-ROM DRIVES Int **$359** Ext **$429**

VIDEO BLASTER **$329** with Microsoft Video for Windows

MPC MEDIA VISION MPC

PRO 16 MULTIMEDIA SYSTEM Internal double speed NEC SCSI multimedia CD ROM drive, Pro Audio Spectrum 16, 5 software titles, FREE DELIVERY — $969

FUSION CD 16 Sony CD ROM drive, proprietary 16 bit sound card, 5 software titles, int/ Ext — $499/$549

PRO MOVIE SPECTRUM Display, capture, edit and playback video on your PC $295

SUB SYSTEM CDPC XL NEW!!! External, fully integrated multimedia component system, FREE DELIVERY — $1,179

COMPTON'S NEWMEDIA **New Interactive Encyclopdia with Virtual Workspace Competitive Upgrade**

$149 call for details!

- One of Wisconsin's Top 10 Women Owned Businesses.
- Corporate, Government & School POs Welcome.
- VISA — No Surcharge on Credit Cards.
- Most Orders Shipped within 48 Hours.
- Software Shipping only $5 per order, not per title. Hardware: 5% - Min. $5.
- C.O.D orders Welcome, with a $5.00 Charge.
- We Ship Latest Version of Software Available.
- All Products Sold Carry Manufacturers' Full Warranties & Documentation.
- APO, FPO HI, AK Puerto Rico & Canadian orders Welcome: 6% - Min $6. International Orders Shipped First Class Mail Insured:15% - Min $15. If mail cost exceeds calculated amount, you'll be billed additional.
- Call for Free Catalog and Items Not Listed

CD ROM DRIVES!

NEC - NEW FOR 93'

CD ROM DRIVES with Multispin
Now with Multispin, 256K buffer & Kodak Photo CD, Multi Session capable
CDR 84-1 Int. / 74-1 Ext. ..... $539/$599

MULTIMEDIA GALLERY with Multispin
Now with Multispin Drive, CDR 74-1 external, soundcard with SCSI interface, 6 software titles, speakers/headphones, FREE DELIVERY $879

CD EXPRESS: CDR-25 external, MPC compliant, 10 software titles, FREE DEL $429

NEC EXTERNAL CD ROM DRIVE:
73M w/Multispin, MPC compliant $469

SONY DESKTOP LIBRARY

CDU 31A Internal MPC compliant, 550MS access time,150KB sustained transfer rate $219

PLUS 3 OTHER PACKAGES:
Internal Multimedia Starter Kit ... $349
Complete Multimedia Upgrade Kit
Internal / External ..... $609 / $779

MITSUMI

CRMC-LU005S, NEW Internal model ... CALL

SMART & FRIENDLY

CD-522 with Panasonic proprietary interface:
Internal / External. ..... $335 / $385

CD-900 with Philips technology:
Internal / External ..... $309 / $359

HS-2200 Internal double speed
with Lotus 123 CD $549

TURTLE BEACH

MultiSound Full MPC Upgrade Kit
MultiSound Sound Card, Texel double speed SCSI internal CD ROM drive, Wave software, King's Quest V, Compton s Multimedia Encyclopedia, FREE DELIVERY ..$1,299

TEXEL

DM-3024 Double Speed CD ROM Drive:
Drive alone, Int. / Ext. ..... $409 / $499
8 bit kit with Trantor interface
Internal / External ..... $489 / $579

TOSHIBA

XM-4301B, Int. Double Speed $489

CD-ROM BONANZA

Buy any CD-ROM Drive or Upgrade Kit Listed in our Ad & Receive CD-ROM Titles at Unbelievable Prices*

$29 ea

- Animals
- Bible Library
- CD Game Pack II
- Chess Master MM MPC
- CIA World Tour
- Electronic Home Library
- Great Cities of the World V 1 or 2
- Interactive Storytime
- International Bus & Econ Atlas
- Loom
- Magazine Rack
- Mavis Beacon Typing MPC
- Monkey Island
- Publish It!
- Secret Weapons of the Luftwaffe
- Sherlock Consulting Detective
- Time Magazine Almanac '91
- Time Table Science & Innovation
- Toolworks Reference Library
- US Atlas w/Automap
- US Atlas MM or US History
- Wing Comm. w/ Missions 1 & 2
- Wing Commander/Ultima VI
- World Atlas for Windows
- World and US Atlas Pak

$49 ea

- National Geographic Mammals Multimedia Encyclopedia
- Q&A V.4 0
- Toolworks Multimedia Encyclopedia DOS
- Toolworks Multimedia Encyclopedia Windows

*** Special prices good only at the time of purchase of drive or package.**

THE SOFTWARE TOOLWORKS

P.O.Box 17882
Milw, WI 53217
(414) 357-8181
FAX: (414) 357-7814
Toll Free FAX:
(800) 554-9981
HRS: CST
9am-9pm, M-F
11am-5pm, Sat

Prices & availability fluctuate beyond our control & may change for better or worse. We do not guarantee compatibility. We are not responsible for manufacturer's coduents. Defective returns must have a Return Authorization number. Call our 1-800# to obtain a Return Authorization or your return will not be accepted. Shipping & handling are non-refundable. All sales are final.

• SOFTWARE • SOFTWARE • SOFTWARE • SOFTWARE • SOFTWARE • SOFTWARE • SOFTWARE •

386 To The Max 6 0 w/Move Em	58 95
ABC FlowCharter 2 0	278 95
ACT! 2 1 / for Win 1 0	214 95/229 95
Access IBM CD ROM/Windows	28 95
Action Plus 5 0	329 95
After Dark for Windows V 2 0	28 95
Air Clear 1 2	176 95
All Type DOS & Windows	42 95
American Heritage Dictionar DOS	57 95
[illegible]	234 95/234 95
[illegible]	58 95
Animation Works Interactive for Win	262 95
Approach for Windows 2 0	247 95
[illegible]	207 95
Auto Map/Windows	52 95/54 95
Auto Map DOS to Window Upgrade	38 95
Auto Sketch 3 0/for Win	83 95/166 95
Auto Works	43 95
BitCom for Windows	28 95
BitCom / BitFax for Windows Bundle	47 95
BitFax / OCR for Windows	88 95
BizPlan Builder V 4 0a	74 95
BodyWorks	43 95
Borland C++ 3 1 for Windows	329 95
Borland C++ 3 1 & Application Frameworks	504 95
Borland Pascal with Objects 7 0	339 95
Brief 3 1	89 95
CA Clipper 5 01	462 95
CA Clipper Tools II	429 95
CA Cricket Graph for Windows 1 3	76 95
CA Cricket Image for Windows	82 95
CA Cricket Paint for Windows	81 95
CA Cricket Presents for Windows 1 4	117 95
CA Complete for Windows	287 95
CA dBase IV Compiler Kit	739 95
[illegible]	317 95
CA Realizer for Windows	71 95
CA Simply Business	392 95
CA SuperCalc 5 5	87 95
CA Super Project 2 1	519 95
CA Super Project 3.0 for Windows	519 95
CA Super Project for DOS	519 95
CA Textor for Win w/Grammatik 5	69 95
CA Up to Date for Windows	[illegible]
[illegible]	46 95/52 95
Central Point Anti-Virus 1 3/Windows	85 95/85 95
Central Point PC Tools Deluxe 8 0	117 95

Check It Pro	53 95
CP PC Tools Deluxe 8 0 w/Stacker	164 95
Chemistry Works	38 95
Close-Up DOS & Windows Dual Pak 4 0	114 95
Corel Draw 3 0 for Win w/CD	369 95
Corel Draw 3 0 for Windows (CD only)	154 95
Corel Draw Upgrade	129 95
[illegible]	63 95
Correct Grammar 4 0 for DOS/Win 2 0	53 95/53 95
Co-Session 6 01 (2 user)	95 95
[illegible]	41 95
dBASE IV 1 5	527 95
Delta Graph Professional for Win	316 95
Deluxe Printshop	44 95
Describe Word Processor 3 0 for Win	319 95
Design CAD 2D 5 0	163 95
Design Cad 3D 4 0	232 95
Design CAD Professional Version	529 95
DESQview/X	161 95
Direct Access 5 1/1 0 for Win	59 95/59 95
DR DOS 6 01	54 95
Drafix Windows CAD 2 1	407 95
Easy Tax	46 95
Eclipse Fax SE	64 95
Enable OA 4 5	464 95
[illegible]	87 95
[illegible]	95 95
First Apps V-2 0	54 95
First-Hand History of America	44 95
Flow Charting 3 2 1 (single user)	132 95
Foreign Language Translation	266 95
FrameMaker 3 0 for Windows	499 95
Freelance Graphics 2 0 for Win	329 95
Golden Retriever for Windows	48 95
Grammatick V for DOS/Windows	54 95/54 95
Graphic Works for Windws	179 95
Harvard Graphics 3 0/Windows	398 95/357 95
Hijack V 2 1 / Windows	117 95/117 95
Home Medical Advisor 2 0/Windows	59 95/59 95
[illegible]	79 95
Instant Database 2 0	67 95
Key Map/Key Map Cales	35 95/39 95
Laserit Pro 4 0/Upgrade	[illegible]
[illegible]	Call
Lotus Organizer 1 0	[illegible]
[illegible]	457 95/437 95
Mac in DOS/Windows	[illegible]

Major BBS, The	139 95
Managing Your Money V 9 0	35 95
Math Type 3 0 for Win	127 95
Merriam Webster Dictionary w/Thesaurus for Win	29 95
More Fonts V 3 0	71 95
[illegible]	CALL
MS Basic Dev Sys. 7 1	302 95
MS DOS 5 0 w/Hologram	74 95
MS Excel 4 0 for Win	297 95
MS Flight Simulator 4 0	38 95
[illegible]	244 95
MS FoxGraph	181 95
MS FoxPro 2 5	299 95
MS Fox Pro for Windows	309 95
Ms FoxPro for Windows MS License pak	274 95
Ms FoxPro for MS-DOS	309 95
FoxPro for MS-DOS MS License pak	274 95
MS Macro Assembler V 6 0	91 95
MS Office for Windows V 2 5	459 95
[illegible]	899 95
MS PC Word Plus w Address Book Plus	209 95
MS PC Word Plus for Windows Upgrade	119 95
MS PC Works 3 0 for DOS	94 95
MS Power Point 3 0/ Windows	244 95/302 95
MS Project 4 0/3 0 for Windows	302 95/424 95
MS Publisher for Windows	119 95
MS Quick C 2 5	81 95
MS Quick C/Quick As 2.51	122 95
MS Quick C for Windows	122 95
MS Quick C for Windows/SDK	454 95
[illegible]	81 95
MS Schedule Plus for Windows	121 95
MS Source Profiler	49 95
MS Test for Windows	242 95
MS Toolbook 1 5	274 95
MS True Type Font Pack	52 95
MS Visual Basic 2 0 for Windows or MS-DOS	
[illegible]	119 95
Professional Edition	304 95
MS Windows 3.1/Upgrade	88 95/49 95
MS Windows for Workgroups 3 1	154 95
Add-On for Windows 3 1 Users	63 95
MS Win Software Dev Kit 3.1	214 95
MS Word for Windows V 2 0	294 95
MS Word for Win Upgrade	119 95
MS Works for Win / Upgrade	119 95/74 95
My House	57 95

[illegible]	[illegible]
Norton Antivirus V 2 1 DOS & Win	81 95
Norton Desktop for DOS/Windows	112 95/112 95
Norton Utilities 6 01	119 95
Nutshell + II	206 95
Object Vision 2 1 w/Runtime	99 95
Omnipage Pro 2 0	624 95
On Time for Windows	68 95
[illegible]	34 95
Pack Rat (need win) V 4 1	229 95
Page Keeper	564 95
PaperWorks	144 95
[illegible]	61 95
[illegible]	Call
PC Animate Plus V 2 0	104 95
PC Anywhere V 4 5 Host & Remote	114 95
PC File 6 5	79 95
[illegible]	93 95
Peachtree Accounting for Windows	89 95
Peachtree Complete 6 0 w/DQ	174 95
Peachtree Network Accounting 6 0	282 95
PFS: 1st Choice	84 95
PhotoEdge CD ROM/Windows	154 95
PhotoFinish 2 0	112 95
PhotoMagic 1 0	97 9
[illegible]	88 95
Presentation Task Force 4 0 for Win	116 95
Print Cache 3.0	67 95
[illegible]	258 95
Professional Write Plus for Win 1 0	159 95
Procomm Plus 2 1/Win	68 95/93 95
Prodigy Starter Kit V 3 1	25 95
Publish It! 3.1 for Windows	79 95
Q & A Network Pack V 4 0	314 95
Q & A V 4 0	244 95
Q DOS III 1 5	53 95
Q-DOS Collection	Call
[illegible]	57 95
QmodemPro 2 0	58 95
Quattro Pro /for Windows	94 95
Quattro Pro 1 0 Competitive Upgrade	136 95
[illegible]	25 95
QuickPay 2.0	36 95
Quicken 6 0/2 0 for Win	39 95/27 95
Quicken Companion	15 95
Quicken for Windows Busines Pack	53 95
Rooms for Windows	58 95

Roots III: Geneology	124 95
Screen Craze II for Windows	29 95
Sideways 3 3	52 95
SmallTalk V for Windows	309 95
Smart Investor	54 95
Spanish Assistant 3 0	55 95
Spinwrite II 3.0	75 95
Squeeze for Windows	55 95
[illegible] 3 0	89 95
Star Trek Screen Savers for Win	32 95
Stepway	82 95
Super PC-Kwik 5 0	77 95
SuperBase 2 0	234 95
SuperCalc 5 1	87 95
SuperOffice Windows	264 95
SuperStor 2 0	53 95
SuperStor Pro for Win	79 95
Tax Cut, State Version	46 95
The USA State Fact Book	33 95
TimeLine 3 0 / Windows	438 95/438 95
Timeslips 5 0	182 95
TrueType for DOS	50 95
Turbo C++ 3 0 / Windows 3 1	66 95/99 95
Turbo Pascal 7 0 / for Windows	[illegible]
Turbo Tax / for Win	44 95/44 95
[illegible]	[illegible]
Untouchable 1 1	60 95
U S Civics	33 95
Virtual Reality Studios 2 0	58 95
ViSio for Windows	192 95
VistaPro	64 95
WildCat BBS Single Line	79 95
Windows Draw 3.0	92 95
Windows Express	54 95
WinFax Pro 2 0	76 95
WinMaster w/Super PC-Kwik	44 95
[illegible]	43 95
[illegible]	119 95
WordPerfect 5 1/5 2 Windows	[illegible]
[illegible]	
[illegible]	[illegible]
Works for Writing (WordStar bundle)	[illegible]
[illegible]	77 95/77 95
XTraDrive Software for DOS	53 95
XTree for Window 1 0	63 95

CALL FOR UPGRADES

NO SURCHARGE ON CREDIT CARDS !

MIDWEST COMPUTER WORKS

QUALITY SERVICE & GUARANTEED LOWEST PRICING!

NO SURCHARGE ON CREDIT CARDS !

NOTEBOOK COMPUTERS

AST PowerExec 386EL25 60MB 1879
AST PowerExec 486SL25 80MB 2659
AST PowerExec 386SL25 80MB Color 3385
Compaq Contura 3/20 84MB W+ 1449
Compaq Contura 3/25 84MB W+ 1749
Compaq Contura 3/25 84MB Color 2189
Compaq LITE 386SL 20 40MB 2229
Compaq LITE 386SL 25 60MB 2599
Texas Instr 486 16WinSX 80MB 2149
Texas Instr 486 25WinDX 120MB 2835
Texas Instr 486WinDX2-50 200MB 3399
Texas Instr 486WinDX2-40 200m Color CALL
Toshiba T1800SX/20 60MB 1339
Toshiba T1850SX/25 80MB 1689

COMPUTERS

AST Power Premium 386SX/25 1329
AST Power Premium 386DX/25 1649
Compaq Prolinea 386/25ZS mdl 40 819
Compaq Prolinea 486/33 mdl 84 1559
Compaq Deskpro 486/33i M240W+ 2379
Compaq SystemPro ..... ALL MODELS
DTK 286/386-486 ..... custom quotes CALL
DTK 486-50 tower 4mb SVGA no-HD 1499
Wyse Terminals 30/50/60 ..... 294/375/298

DISK DRIVES

Conner CP30204 210MB 12ms IDE 419
Conner CP3544 540MB 12ms IDE 949
Iomega PC Powered 90 w/adapter 529
Maxtor 7213A 213MB IDE 399
Maxtor LXT340A 340MB IDE 699
Micropolis ..... ALL MODELS ..... CALL
Pacific Rim External floppy drives ..... CALL
Quantum drives ..... ALL MODELS ..... CALL
Plus Hardcard EZ 42MB 209
Plus Hardcard EZ 240MB 569
Seagate ST3144A 130mb 16ms IDE 299
Teac dual floppy drive 149
Teac 3 5" or 5 25" floppies 79
Toshiba 3 5" or 5 25" floppies 69

MATH CO-PROCESSORS

Cyrix 80387SX-16/20/25 69
Cyrix 80387DX-16/20/25/33 89
IIT 80387SX-16/20 59
IIT 80387DX-16/20/25/33 79
Intel 80387SL 79
Intel 80387SX-16/20/25 79
Intel 80387DX-20/25/33 89
Weitek ..... ALL MODELS ..... CALL

MEMORY PRODUCTS

AST Prem Exec 4MB 179
Okidata Laser 400 2MB 129
Panasonic KXP-4410/4430 1MB 119
Texas Instr MicroLaser 1MB 79
256x4 80ns DRAM 4 40
256x9 80ns SIMM ..... CALL
1MBx9 80ns SIMM ..... CALL
4MBx9 70ns SIMM ..... CALL

MICE

Logitech Dexxa 3-button serial/PS/2 39
Logitech Dexxa w/Windows 3.1 89
Logitech Kidz mouse w/software 49
Logitech Mouseman 79
Logitech Trackman Portable 95
Microsoft bus or serial 400 dpi 89
Microsoft Ball Point mouse 125

PRINTERS

PANASONIC

KXP1180i/2180 ..... 154/175
KXP1123/2123 ..... 199/244
KXP1124i/2124 ..... 279/319
KXP1824 339
KXP1654 539
KXP2624 376
KXP4410 Laser 639
KXP4430 Laser 896
KXP4450i Laser ..... CALL
KXP4455 Laser ..... CALL

NEC

P3200/P3300 ..... 239/339
P6200/P6300 ..... 419/629
P9300 869
LC95 Postscript 1379
LC97 Postscript 1799
ColorMate Postscript 4499

DICONIX by Kodak

180si 295
701 Inkjet 425
Color4 Inkjet 599

OKIDATA

184 Turbo 215
320/321 ..... 305/429
590+/591+ 435/595
Laser 400 595
Laser 810 999
Laser 830/840 ..... 1278/1555

HEWLETT PACKARD

HP Portable 409
Deskjet 500 398
Deskjet 500C 516
Deskjet 550C ..... CALL
LaserJet IIP+ 819
LaserJet IIIP 949
LaserJet IV 1399
LaserJet IIID 2349
LaserJet IIISi 3229
Paintjet / Paintjet XL ..... CALL
Paintjet XL 300 2259
Scanjet 2P 849
Scanjet 2C 1444
Plotters ..... ALL MODELS

IBM

IBM Execjet 679
Laser 6 6P 1279/1475
Laser 10/10P 1369/1889
Laser 6A/10A 1649/2119

CANON

BJ-10EX Bubblejet 259
BJ-20 w/feeder 399
BJ-200 349
BJ-300/330 ..... 369/599
BJC-800 color ..... NEW

STAR

NX1020R Color 185
NX2420R Color 305
XB2420 Color 469

CITIZEN

GSX-230/145 ..... 259/379
PN48 PN48Pro 299/349

COMPAQ

Pagemarq 15 3259
Pagemarq 20 4479

QMS

410 Postscript 1489
815/815MR 2869/3569
825 825MR 3359/4625
860 Hammerhead 3988
Colorscript 210 4519
Colorscript 230 7495
PS1700 6269
PS1725 5369

TEXAS INSTRUMENTS

MicroWriter Basic ..... NEW
MicroWriter PS17 ..... NEW
MicroWriter PS35 ..... NEW
Microlaser Basic 859
Microlaser Basic XL 1729
Microlaser PS17+ 1179
Microlaser PS35+ 1277
Microlaser XL PS17 1999
Microlaser XL PS35 2269

SEIKO

Smart Label Printer+ 139
Smart Label Printer Pro 229
CH-4104 Color Laser 2549

PLOTTERS & DIGITIZERS

Calcomp 12x12/12x18 ..... 297/597
Hewlett Packard Plotters ..... ALL MODELS
Kurta 12x12 XLP/12x17 ISeries 249/537
Pacific Data ProTracer 1099
Summagraphics 12x12/12x18 ..... 312/549

BATTERY BACKUPS

American Power BK400 desktop 159
American Power AP400 slimline 299
American Power AP600 slimline 389
American Power AP900 slimline 555
American Power Surge Arrest Plus 39
Tripp Lite BC500 179
Tripp Lite BC750 389
Tripp Lite Iso Bar 4 44

MODEMS

Boca Modem 14 4 v 32bis internal 229
Cardinal 2400 baud int MNP-5 softwr 59
Hayes Optima 14 4 + Fax 14 4 int 449
Intel Satisfaxtion 100-400i 98/398
Megahertz modems for all laptops ..... CALL
Practical Periph 14 4 send/rec fax int 359
US Robotics Sportster 14 4 fax/mdm int 339
US Robotics Courier HST 16 8 ext 549
Worldport Fax/Modems for laptops ..... CALL
Zoom V 42 bis w/mnp external 119
Zoom VFXV32 96/96 send/rec fax ext 269

SCANNERS

Hewlett Packard Scanjet 2P 849
Hewlett Packard 2C 1444
Logitech Scanman 256 269
Logitech Scanman Color 579
Microtek Scanmaker II color 879
Microtek Scanmaker II XE 1199

SOFTWARE

Adobe Type Manager 2 0 59
Adobe Illustrator 4 0 429
Aldus Pagemaker 4 0 499
Borland Quattro Pro 299
Caere Omnipage Direct 249
Calera WordScan Plus 1 1 399
Calera Faxgrabber 69
Central Point PC Tools 8 0 119
Corel Draw 3 0 369
Delrina Winfax Pro 75
Lotus 1-2-3 ver 1 1 Win 299
Microsoft Office 3 0 479
Microsoft Windows 3 1 89
Microsoft Word for Windows 2 0 298
PC Anywhere 4 5 119
Presentation Task Force V4 0 119
Symantic Norton Desktop 115
Stack Elec Stacker 89
Word Perfect 5 1 269

1000'S OF TITLES IN STOCK !

CD-ROM/MULTIMEDIA

Creative Labs Multimedia Starter kit 449
Creative Labs Multimedia Upgrade 559
Media Vision Pro Audio Spectrum Plus 149
Media Vision Pro Audio Spectrum Plus 16 199
Media Vision Fusion 16 Upgarde kit 499
NEC CD Express bundle 425
NEC CDR-84/74 ..... 539/599
NEC Multimedia Gallery 869
NEC CDR-84 Multimedia Upgrade 1129
Sony CD-31A internal drive 229
Sony CD-31ALLN bundle 379
Sony CD-31ALLL multimedia bundle 629
Sony CDU-7305 ext Multimedia bundle 799
Soundblaster Pro w/Midi 189
Toshiba XM3401 internal 479

TAPE BACKUP

Colorado DJ-10 40-120MB int 159
Colorado DJ-20 120-250MB int 219
Colorado Trakker 120MB parallel port 349
Colorado Trakker 250MB parallel port 419
Colorado QFA-700 250-700MB int 719
Irwin A120PC 40-120MB int 237
Irwin A250PC 250MB int 297
Maynard Maynstream 2 0gig DAT intl 2599
Mountain FS4000 120MB int/ext 249/459
Mountain FS8000 250MB int/ext 499/CALL

MONITORS

Goldstar 1460 14" 1024x768 28mm 279
Idek MF5117 17" 1024x768 919
Idek MF5217 17" 1024x768 26mm 1049
MAG MX15F 15" 1280x1024 26mm 599
MAG MX17F 17" 1280x1024 26mm 1099
Mitsubishi DiamondPro 17" 1280x1024 1119
Mitsubishi HL6955 20" 1280x1024 1849
Nanao F340i 15" 1024x768 28mm 729
Nanao F550i 17" 1280x1024 28mm 1138
Nanao T560i 17" 1280x1024 26mm 1749
NEC 3FGX 15" 1024x768 28mm ..... CALL
NEC 4FG 15" 1024x768 28mm 749
NEC 5FG 17" 1280x1024 28mm 1249
NEC 6FG 21" 1280x1024 28mm 2299
Panasonic C-1381i 14" 1024x768 319
Panasonic C-1395 14" 1024x768 ni 425
Samsung ML 4571 14" mono VGA 129
Samsung SyncSc 17" 1280x1024 flat 999
Seiko 1440i/1450 14" VGA 25mm 398/439
Seiko 1760 17" 1280x1024 25mm 1049
Seiko 2050 20" 1024x768 31mm 1789
Sony CPD1430 14" 1024x768 25mm 599
Sony CPD1604S 17" 1024x768 25mm 1008

VIDEO BOARDS

ATI VGA Integra 1024x768 512k 79
ATI VGA XL24 24-bit 1MB 145
ATI Vantage 1MB w/mouse 215
ATI Graphics Ultra + 1MB w/mouse 295
ATI Graphics Ultra Pro 1MB w/mouse 425
ATI Graphics Ultra Pro EISA 2MB 599
Boca Basic VGA 640x480 59
Boca SVGA 1024x768 512k/1MB 129/149
Diamond Speedstar 24X 1MB 24-bit 159
Diamond Stealth Hi-Color 1MB 212
Hercules Gold series ..... CALL
Number Nine GXi / GXe series ..... CALL
Orchid Pro Designer IIs 1MB 189

NETWORKING

3COM 3C503 Etherlink II 189
3COM 3C509 Etherlink III 139
Digiboard ..... ALL MODELS ..... CALL
Intel Ether Express 16-bit coax 134
Lantastic Ethernet AE-2 Starter Kit 149
Lantastic Windows AE-2 starter Kit 409
Netware 2.2 5-user / 10-user 479/1054
Netware 3 11 5-user 574
Netware 3 11 10-user 1299
Netware 3 11 20-user 1795
Netware 3 11 50-user 2999
Netware 3 11 100-user 3647
Netware 3 11 250-user 6695
Netware 3 11 Premium 5 to 250 user ..... CALL
Netware Upgrades Available ..... CALL
Netware Lite software 65
NE1000/NE2000 Boards 99/142
SMC Arcnet PC130/270E 69/108
SMC Arcnet PC600W/S PC600FS 129/208
SMC Ethercard+ Elite/Elite16 ..... 119/139
Tiara 0111/0196 ..... 89/129
Thomas Conrad 6245 Arcnet 16-bit 178
Xircom pocket lan adapters ..... CALL

FAX MACHINES

Hewlett Packard FAX series ..... NEW
Panasonic UF312 plain paper 1449
Canon ..... ALL MODELS ..... CALL

WHY MIDWEST COMPUTER "WORKS" FOR YOU

WIDE SELECTION

Huge inventory. Thousands of items in stock and ready for immediate shipment!

ON-TIME

In-stock orders are shipped the same day. We are fast & efficient.

RELIABILITY

We earn your business! Over 70% of our orders are repeat customers.

KNOWLEDGEABLE

All of our salespeople are technically trained to provide you with the right solution!

SERVICE

If you don't find it..ask, our friendly staff will special order products for you!

NEW! **AST**

POWEREXEC EL 25Mhz

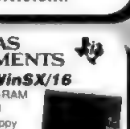
- Intel 386SL 25MHz 2mb RAM
- Expandable to 20mb RAM
- 1 44mb built-in floppy
- 60MB hard drive
- VGA white 9 5" LCD display
- 1-ser, 1-par VGA, mouse or keyboard ports
- 5 9 lb 8 5"D x 11"W x 1 8"H
- 3 to 4 hour battery life

$1679

TEXAS INSTRUMENTS

TM4000 WinSX/16

- Intel 486SX 16MHz 4mb RAM
- Expandable to 8mb RAM
- 80mb hard drive 3 5" floppy
- 10" VGA Display 1MB RAM
- 1 ser 1-par VGA mouse or keyboard ports
- Windows 3 1 w/mouse
- 5 6 lb 8 5"D x 11"W x 1 8"H
- 3 to 5 hour battery life

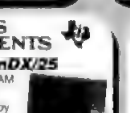


$2149

TEXAS INSTRUMENTS

TM4000 WinDX/25

- Intel 486DX 25MHz 4mb RAM
- Expandable to 20mb RAM
- 120mb hard drive 3.5" floppy
- 10" VGA Display 1MB RAM
- 1-ser, 1-par VGA mouse or keyboard ports
- Windows 3 1 w/mouse
- 5 6 lb 8 5"D x 11"W x 1 8"H
- 3 to 5 hour battery life

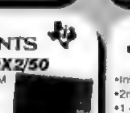


$2835

NEW! **TEXAS INSTRUMENTS**

TM4000 WinDX2/50

- Intel 486DX2 50MHz 8mb RAM
- Expandable to 20mb RAM
- 200mb hard drive 3.5" floppy
- 10" VGA Display 1MB RAM
- 1-ser, 1-par VGA mouse or keyboard ports
- Windows 3 1 w/mouse
- 5 6 lb 8 5"D x 11"W x 1 8"H
- 3 to 5 hour battery life



$3399

COMPAQ

Contura

- Intel 386SL 20 or 25MHz
- 2mb RAM expandable to 10
- 1 44mb built-in floppy
- 40 60 84 or 120mb HD
- VGA 9 5" LCD display
- 1-ser, 1-par, VGA, keyped and keyboard ports
- 5.2 lb 8 9"D x 11 7"W x 1 9"H

CALL FOR PRICES

MICROTEK

ScanMaker II XE

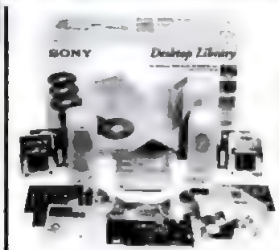
OUR #1 SELLING COLOR FLATBED SCANNER

This incredible high speed scanner can transform your originals into stunning 24-bit color, 8-bit grayscale or 1-bit B&W images at resolutions up to 1200 dpi! Included with the ScanMaker II XE is **ALDUS PHOTOSTYLER** image editing software a $795.00 retail value!

ScanMaker II* w/ImageStar II	ScanMaker II XE w/Photostyler
$879	**$1199**

Available options: 50-page Automatic document feeder, Transparency scanning adapter

* Same specifications as II XE model but with ImageStar II software



model CDU31A-LLI

SONY

SONY CD DESKTOP LIBRARY

System includes: Internal tray loading CD-ROM player that is MPC & Multi-session Photo CD compliant, Pro Audio Spectrum 16 sound board and stereo amplified speakers with batteries.

Software included: New Groliers Encyclopedia, Great Wonders of the World, Time Magazine Compact Almanac, Where in the World is Carmen Sandiego, The Presidents: It all Started with George, Tempra Access and GeoWorks CD-ROM Manager!

All for only **$629.00**

(External version CDU 7305 also available $799 00)

MIDWEST COMPUTER WORKS

180 Lexington Drive, Buffalo Grove, IL 60089

DIRECT ORDER LINE

800-85-WORKS

(800-859-6757)

TECH SUPPORT & CUSTOMER SERVICE 708-459-6883 • FAX 708-459-6933

WE GUARANTEE THE LOWEST PRICES AND THE BEST SERVICE!

- C O D orders accepted
- Your credit card is not charged until the product is shipped
- Personal and company checks
- Call us for quantity discounts
- Prices subject to change
- We check for stock availability
- No extra charge for credit cards
- Foreign orders are welcome

PC MAG 02/01/1993

CIRCLE 010 ON READER SERVICE CARD

Telemart just made WordPerfect

perfecter.

Order today, receive **By Design** desktop publishing software **FREE**.

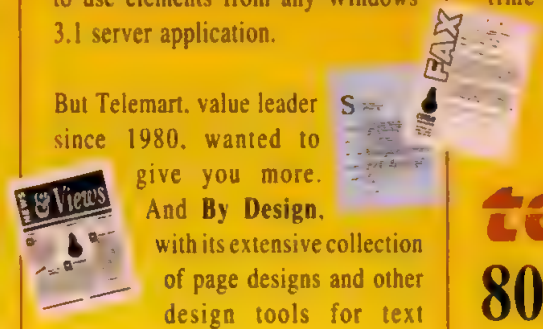
Telemart, winner of 8 BEST BUY AWARDS since 1988, has tied up yet another incredible offer.

Now, for a limited time only, when you order the latest and greatest in word processing, WordPerfect 5.2 for Windows, you will receive By Design, the powerful desktop publishing tool that works within WordPerfect, at no extra charge!

The new **WordPerfect 5.2** has retained powerful feature favorites like Ruler, Zoom Edit, Button Bar, Speller, while becoming mail-enabled and adding Grammatik 5, Adobe Type Manager Fonts, QuickFinder for fast and easy file searches, and OLE (Object Linking & Embedding) Support that allows you to use elements from any Windows 3.1 server application.

But Telemart, value leader since 1980, wanted to give you more. And **By Design**, with its extensive collection of page designs and other design tools for text enhancement, is the perfect compliment to the most powerful word processing package available today.

Telemart has done it again! And this time they've managed to make **WordPerfect** perfecter!



telemart

800-521-1973

CIRCLE 101 ON READER SERVICE CARD

reservations and cost less than $2,500.

The least expensive system I found was Hotel Perfect (Micro Perfect Corp., 225 W. 34th St., #1001, New York, NY 10122; 212-629-6082; $495 for the single-user version, $1,495 for the multiuser version). Hotel Perfect tracks room availability, creates checkout invoices, and handles payments. It also handles both individual and group reservations; keeps track of guest histories, housekeeping duties, and guest parking; and can log messages for your guests. It can import data from a phone-tracking system and export data to a TV-based quick checkout system if you have one.

Polygon Industries (P.O. Box 24096, New Orleans, LA 70185; 800-326-7083, 504-451-5721) sells Front Desk Master, a package that supports DOS and various versions of Unix; the DOS package is $1,995. It includes support for individual and group reservations, tracks housekeeping and guest billing, and also supports interfaces to telephone billing systems. Front Desk Master gives you the option of storing the data in dBASE-compatible .DBF files instead of its proprietary format, which lets you create your own specialized reports or bills. The base price includes on-site installation, though the Polygon representative stated that special arrangements would probably have to be made for Australia.

Execu/Tech Systems (118 Village St., Suite A, Slidell, LA 70458; 504-737-9435) has a complete line of motel and hotel management software that ranges from single-user DOS systems to multiuser Unix systems.

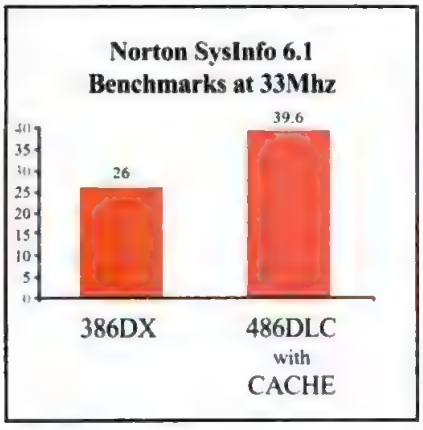
Execu/Tech's software is modular, so you only have to purchase what you need; they also give full credit for the purchase price of your existing software when you upgrade from a single-user system to a multiuser system. Execu/Tech's base packages are stripped-down versions of their full system, designated by "motel" in the product name; the base system may be sufficient for your needs. The Motel Reservations module ($495) handles individual and group reservations, including setting aside blocks of rooms, guest deposits, and seasonal rates. The Motel Front Desk, Housekeeping, Manager, and Night Audit module ($695) adds checkin/checkout reports, guest invoices, and housekeeping schedules.

The full system starts with Hotel Reservations ($1,095), which adds support for guest prepayments from travel agencies. The Hotel Front Desk, Housekeeping, Manager, and Night Audit module ($1,995) adds the front desk capabilities. Other modules are available that provide accounting functions such as general ledgers, payrolls, phone call tracking and in-room movie charges, and multiuser versions are available for Xenix and Unix.

Front Desk 2.0 (Front Desk Systems, P.O. Box 178504, San Diego, CA 92177; 800-877-2917, 619-273-9498) comes in two DOS-based systems that support individual or group reservations, guest billing, and guest payments. The base package costs $650; an enhanced package, which adds night audit reports, full guest reports, and the ability to project room occupancy for the next 55 days, sells for $2,000.—*Joe Salemi* □

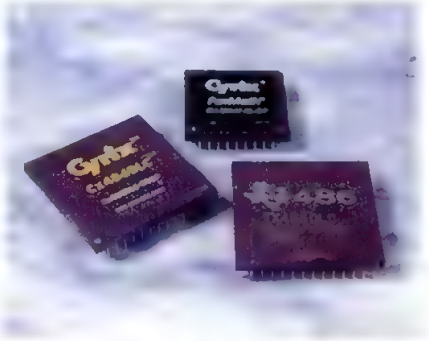
486 POWER FROM ONLY $199

It's easy! It takes just a few minutes to replace your current, socketed 386DX with the Buffalo 486 Power Kit™. Now you can have faster video and graphics, the superior number-crunching power of a 486 and, when you add the available math co-processor, you can have even more computing power for minimum cost. Don't buy a new PC when you don't have to. Our upgrade chips can give you the computing power you need at a very reasonable price.



Each Buffalo 486 Power Kit™ includes cache-activating software to allow users to engage the 1Kbyte cache of the 486DLC for substantially improved performance. No further hardware change is required. With the cache activated, tests show Norton SI improvement of over 50% for 33Mhz. systems. The 486 Power Kits offer a simple, economical approach to upgrading PCs with socketed 386DX CPU chips. An easy installation guide and a chip removal tool are also included in each kit.

POWER
Accomplish more than ever before.
SPEED
It's up to 150% faster.
SAVINGS
Why spend $1,000 or more for a motherboard replacement? The Buffalo 486 Power Kit provides the performance for a fraction of the cost.
EASY INSTALLATION
You can be running your 486 in minutes! An installation guide and a chip removal tool are included.



BUFFALO

US AND CANADA TOLL-FREE
1-800-345-2356

(503) 585-3414
FAX (503) 585-4505
Buffalo Products, Inc.
2805 19th St. SE, Salem, OR 97302

Response Code: F3PK1

BUFFALO is a registered trademark of Melco Inc. 486 Power Kit is a trademark of Buffalo Products Inc. All other brands and product names are trademarks or registered trademarks of their respective owners.

CIRCLE 328 ON READER SERVICE CARD

telemart

ORDER IT TODAY. . .USE IT TOMORROW

PRINTERS

LASER

Compaq All Models ..... Call
Hewlett Packard
- Desk Jet 500 409
- Desk Jet 550C 519
- Laser Jet IIIP 975
- Laser Jet IV 1449

Okidata OL-400 Par. 629
Texas Instruments MicroLaser + ... 869

DOT MATRIX

Citizen All Models ..... Call
Compaq All Models ..... Call
Epson
- LQ570 249
- AP3250 195

Okidata
- 320 318
- 321 ML Par 449
- 590 449

Panasonic
- 1123 206
- 1124i 299
- 1180i 150

OTHER

Canon All Models ..... Call
CoStar All Models ..... Call
Diconix All Models ..... Call
Seiko Smart Label + Printer 135

POINTING DEVICES

Logitech Mouseman Serial Cordless $80
MS Bus or Serial w/Windows 3.1 142

HARD CARDS

Plus Development
- II XL50 MB $204
- II XL105 MB 264
- EZ 127 Int. 323

TAPE BACKUP

Colorado Memory System
- Jumbo 250 ..... $245
- Jumbo 120 Int. 199

Everex All Models ..... Call

CO-PROCESSORS

Cyrix ..... Call
Intel ..... Call

VIDEO-BOARDS

ATI
- Graphic Ultra Pro ISA 2Mb $525
- VGA Wonder XL24 1Mb 142

Creative Labs VideoBlaster 329
Diamond
- SpeedStar 24X 185
- Stealth 1Mb w/Hi-Color 219

Everex All Models ..... Call
Intel All Models ..... Call
Orchid All Models ..... Call

SOUNDCARDS

Advanced Gravis Ultrasound 80 . $127
CL SoundBlaster 2.0 95
CL SoundBlaster Pro Basic 147
Mediavision Pro Audio Spec 16 188

KEYBOARDS

Focus 2001 ..... Call
Keytronics KB101Plus 96

OFFICE ON THE GO

LAPTOP

LapLink Pro v 4.0 ..... $99
Toshiba All Models ..... Call

NOTEBOOK

Panasonic All Models ..... Call
Texas Instruments All Models ..... Call

XTREE FOR WINDOWS

Xtree® for Windows™, the essential companion for Microsoft® Windows, is the only program to combine unsurpassed file management, file viewing and ZIP file compression with powerful, flexible program launching.

$63

MONITORS

Aamazing All Models ..... Call
Amdek All Models ..... Call
Arche All Models ..... Call
Hitachi All Models ..... Call
MAG 17F 1109
Mitsubishi XC 1410 C EGA 239
Nanao F550i 17" 1129
NEC All Models ..... Call
Samsung MA 2565 14" Amber 73
Sony All Models ..... Call
SuperCom 14" SVGA 1024x768 313
ViewSonic All Models ..... Call
Zenith All Models ..... Call

COMMUNICATION HARDWARE

ATI 9600 ETC Ext $273
Cardinal All Models ..... Call
Complete Communicator v3.0 295
Everex Evercom 24+ Ext 120
Hayes OPTIMA 9600 EXT w/SC/EZ . 326
Intel Satisfaxtion Model 400 405
Practical Peripheral PM 14400 EXT 375
Prometheus All Models ..... Call
U.S. Robotics All Models ..... Call
Zoom
- AFX Ext. 76
- AMC Int 46
- AMX Ext 60

DISK DRIVES

Conner Jaguar 170Mb IDE $298
Bernoulli
- Insider Pro 90 558
- Transportable Pro 90Mb 669

Maxtor
- 7120A 248
- 7213A 353

Micropolis All Models ..... Call
Quantum ProDrive240Mb IDE 3.5" ... 426
Seagate All Models ..... Call
Teac 3.5" 1 44 Mb AT 54
Teac 5.25" 1 2 Mb AT 56
Teac 3 5"/5.25" Combo Drive 129
Toshiba 1 2 Mb FDD 59
Toshiba 1 44 Mb FDD 56

OCR / SCANNERS

Complete All Models ..... Call
Logitech Scanman 256 255

CD ROM MULTIMEDIA

SMART & FRIENDLY CD ROM

CD ROM Bundle–
- Sony 535 w/software $347

CD-900 Caddy Less Technology ... 322
CD HS-2200 High Speed Photo CD w/software 560
Floptical 21Mb w/software 312

SONY CD ROM

Photo Ready 31A 229
Other models ..... Call

HIGH SPEED CD ROMS

Hitachi CD-3700 (300ms) 399
NEC
- CD ROM (280ms) 558
- 74 Multimedia Gallery Software CD s, Sound Card & Speakers 859

Toshiba CD-3401 Multissn /Photo (200ms) 554

MULTIMEDIA SOLUTIONS

Chinon CD-431 Software Bndle 390
Creative Labs M M Kit w/Sound BlasterPro Card ..... Call
Corel Blockbuster Bndle Desktop Publishing SW, Clip Art & CD ROM Int. 917
MediaVision M M Kit w/NEC 84 & sound card 937
Mediavision Fusion CD-16 w/Sony 31A & sound card 502

NETWORKING & LAN

SOFTWARE

FoxPro Lan 2.0 - 5 Pak. $547
Novell Netware Lite w/Dr. DOS 50

HARDWARE

Anthem-Eagle
- NE1000 Ethernet Card ..... Call
- NE2000 Ethernet AT ..... Call

Artsoft
- Lantastic AE-2 Ethernet Starter 469
- Lantastic AE-2/T E-Net 16B/TP 193
- Lantastic AI Nos Single Node 54
- Lantastic 2MBPS Adapter 129

Intel EtherExpress 16TP 10BT ..... Call
SMC
- Ethercard Plus Elite 16TP ..... Call
- EtherNet + 16Bit Elite 128
- EtherNet Combo 16TB Coax 163

Tiara 10BT 16Bit Lancard AT ..... Call
Xircom Pocket Adapter PE2-1082 293

DISKETTES

Sony
- 3.5 D/S D/D (100) $65
- 5.25 High Density (100) 109

MITS

- *Always In Stock!!!*
- *30-Day money-back guarantee!*
- *Order it Today. . .Get it Tomorrow!*
- *2 Year Warranty!!!*

- IDEAServcom On-Site Service
- Microsoft EasyDOS 5.0
- 4Mb RAM
- 1.2 &1.44 Drives
- Focus 2001 Keyboard
- SVGA Card
- SVGA Non Interlaced Monitor
- "The Getting Started" Manual with Windows Supplement

386-40/64C 130Mb HD $1299
486-33/64C 213Mb HD 1749
486DX-50/256C 213 Mb HD 1999
Local Bus and Other Configurations Call

TERMINALS

Wyse
- 30+ 285
- 80+ 285
- 150+ Amber 269
- 150+ White 269

PRESENTATION GRAPHICS

Corel Draw Comp Upgrade $165

OPERATING ENVIRONMENTS

MS Dos 5.0 Upgrade $91
MS Windows Ver 3.1 91
MS Windows Ver 3.1 Upgrade 49

PROFESSIONAL DESKTOP PUBLISHING

Pagemaker 4.0 ..... $499

DATA BASE MANAGEMENT

Paradox 4.0 ..... $525
Q&A v4.0 249

WINDOWS

AutoSketch for Windows $169
BitFax for Windows v2.0 45
MS Access for Windows 89
MS Excel for Windows 293
MS Excel for Windows Comp Upgrde . 118
MS Money for Windows 150
MS Office for Windows 454
MS Publisher for Windows 120
MS Word for Windows 299
MS Works for Windows 120
Norton Desktop/Windows 117
ProComm Plus Windows 92
Quicken v2.0 for Windows 38
Visio 196
Winsleuth Gold 89
Winspeed 45

INTEGRATED

Hsaak Windows $118
WordPerfect Works 89

PERSONAL FINANCE

Quicken v6.0 (DOS) $42

UTILITIES

BACK UP

Fastback Plus 3.1 ..... $93

GENERAL

Copy II Option Board Deluxe $19

HARD DISK MANAGEMENT

Norton Utilities 8.01 ..... $111
PC Tools 8.0 120
Stacker v3.0 91
Superstor Pro 80
Xtree Gold v2.5 66

MEMORY MANAGEMENT

Qemm 386 ..... $56

MENUING SOFTWARE

Direct Access Win/DOS $61/59

PRINT

Print Cache v3.0 ..... $39

SCREEN SAVERS

After Dark $28
Star Trek 35

EDUCATION & GAMES

Bodyworks $43
ChessMaster 3000 30
Kid Pix 35
Mavis Beacon Teaches Typing 30
MS Flight Simulator v4.0 36
Orbits 28
Reader Rabbit II 35
Where in the World Deluxe 45

BUSINESS

AutoMap (DOS) $54
Lotus Organizer 95

SPREADSHEET

CA Supercalc $88
Lotus 123 v2.4 332
Quattro Pro v4.0 Comp Upgrade 219

VISIO™ FROM SHAPEWARE

Finally, a drawing program as accessible as your favorite w processor or spreadsheet program. Everyone can create business or technical drawings with Visio's intuitive drag and drop drawing technique – you don't have to be a graphic artist or draftsman.

$196

ACCOUNTING

QuickBooks $82
QuickBooks Quickpay Bundle 107

COMMUNICATION

Carbon Copy Plus $129
Norton PC Anywhere v4.5 115
PC Anywhere III ..... Call
ProComm Plus v2.0 69
Wildcat! 77
Winfax Pro v3.0 77

PROGRAMMING & LANGUAGES

MS Macro Assembler $89
MS Quick Basic 59
MS Visual Basic/DOS 118
Turbo C++ DOS 67

WORD PROCESSORS

Ami Pro v3.0 ..... $233
WordPerfect 5.2 for Windows 265
WordPerfect 5.1 263
WordPerfect Upgrade 74

FONTS

MS True Type Font Pak I,II $43

POLICIES

- **Order Line Hours: Mon-Fri 6am - 10pm. Sat 9am - 5pm, Sun 8am - 5pm**
- Order Processing (602) 944-1037 10am - 3pm Mon-Fri
- Mailing Address Telemart, 8804 N. 23rd Ave., Phoenix AZ 85021
- **International Orders - Fax (602) 944-1510.**
- International orders add 6%
- Order Today Get it Tomorrow, if we can't keep our promise, we will notify you
- Call Before Submitting P.O.'s. Ask for National Accounts
- Personal and company checks will delay shipping 3 weeks.
- Prices, terms, availability & specifications are subject to change without notice
- Add 5% for C.O.D., A.P.O. & F.P.O. Orders
- Money Back Guarantee Software ONLY 30 days from date of invoice Refund ONLY on Product Price. Call for Return Authorization Number Must be in Original Packaging
- No Charge for VISA and Mastercard.
- We Do Not Charge Your Card Until Your Order is Shipped
- You Pay the Ground Shipping 1-10# - $8.00; 11-20# - $12.00 (Except Alaska & Hawaii) We Pay the Air Difference and Free Air Applies ONLY to Domestic orders up to 20 lbs and over $100.
- All products, including DOA's carry only manufacturer's warrantees. We do not honor guarantees, rebates, trial period privileges or promotional programs offered by manufacturers
- No returns on used or misordered product
- We do not guarantee machine compatibility
- Machine compatibility disclaimer does not apply to MITS systems

PCM32693

A DECADE OF EXPERIENCE DELIVERS

SHIPPING

Most orders shipped in 24 hours... with FREE Air Express

You pay the ground shipping, we pay the air difference!

PRICE

A decade of lowest prices on the products you want.

CONFIDENCE

We do not charge your card until we ship your order. 30 Day Money Back Guarantee on all software. No questions asked.

CONVENIENCE

Extended hours: late nights, Saturdays and Sundays.

SELECTION

When you see this symbol, you're assured that these products have been purchased most often by our national customer base, based on performance and the *telemart* price.

CALL US FOR CUSTOMIZED ACCOUNT SERVICES

International Orders:
1-602-944-3045
Fax 1-602-944-1510
Canada 1-800-752-0590

Purchase Orders:
1-800-521-1970

Dealers/VAR's:
1-800-521-1982

MIT Systems & Networks:
1-800-336-4310

VISA

DISCOVER

1-800-521-1973

The PC Zone
Price, Availability and Service

- Over 2,000 Products
- Hassle-free Ordering
- Knowledgeable Sales Advisors
- Low Prices
- Quality Products
- Latest Releases
- OPEN 24 HOURS
- $6 Overnight Shipping

NOW WE SPEAK YOUR LANGUAGE
• Hablamos Español
• 日本語でどうぞ
• 저희는 한국말을 사용합니다

☎ Outside USA & Canada: Call 1•206•883•3088 / Int'l FAX: Call 1•206•883•6940

ORDER VIA COMPUSERVE TYPE "GO MZ"

Aldus IntelliDraw

$194

IntelliDraw is an exciting drawing program that gives you an easy way to visually experiment, refine and draw your ideas. Smart tools link graphics in your drawing so they respond to changes automatically. Features include intelligent clip art, automatic symmetrical objects and dimension lines. You also get auto-alignment, shape blending, powerful text handling capabilities, unlimited layers, color gradients, easy object animation, slide show mode, standard draw tools and more. Aldus W #11190

Fractal Design Painter 1.2

$258

The Editor-In-Chief of PC Magazine wrote about Fractal Design Painter, "Fabulous ... In short, Fractal Design Painter really captures the feeling of working on a canvas, with all the power and advantages of a computer." Painter creates original art or embellishes scanned images with realistic natural media effects in 24-bit color. Painter includes brushes, pens, chalks and even paper grains (48 included). Perfect for fine artists, graphic artists, students or anyone
Fractal Design W #07475

After Dark for Windows 2.0

$28

It's zany. It's fun. It's functional. It's After Dark for Windows 2.0. Now you can prevent screen burn-in with over 40 incredible displays. Enjoy digital sound, fun graphics, WallZapper (turns an After Dark display into wallpaper), Network Password Support and password protection.
Berkeley Systems W #07787

XtraDrive

$58

Is your disk drive big enough to support your software needs? XtraDrive instantly doubles the capacity of your drive without the cost of a new one. XtraDrive works transparently in the background by compressing the files on your drive. A second drive equal in size to your original drive is created. XtraDrive's patented loss-less data compression technology keeps your data safe. It takes just a few menu-driven commands to install, and it supports de-installation without reformatting.

So why invest in another hard drive when XtraDrive offers the same benefits in an affordable software solution? XtraDrive is the perfect solution for older systems that just can't keep up with software storage requirements, or for laptops running Windows.
Integrated Information B #11418

Mighty Draw

$24

Mighty Draw is a very affordable general purpose, object-oriented drawing program that allows you to create any visual you can think of—from pie charts to graphs, network diagrams to newsletters, and more. Mighty Draw also offers an extensive library of hundreds of pre-drawn images. Mighty Draw is the easy drawing program that will make you look great. Abracadata D #11735

Design Your Own Railroad

$38

Better than a model railroad in your basement! With Design Your Own Railroad you can design precision, to-scale (HO, N, O, Z, S, I, or a custom scale) layouts using the unique track laying tools. Then use the comprehensive set of drawing tools to create scenery and depots. Finally, design and build your trains. Now you're ready to run a realistic railroad simulation, complete with switches, scale time, revenue tracking, freight and even crashes. Abracadata D #09944

Design Your Own Home ...

$34 EACH

Whether you are a professional or a do-it-yourselfer, Design Your Own Home can make your planning time more productive. Each program includes sample plans and a try-out section to get you started, plus command cards to keep by your side as you work. The Interiors program offers pre-drawn furniture and kitchen/bath objects. Four side views are automatically created from your top-view drawing. Architecture lets you print floor plans to scale, with 24 drawing scales, grids and snap lines, overlays for plumbing or electrical plans, automatic calculation of number of boards used, auto-dimensioning and much more. The Landscape program lets you place trees, fences, etc., or draw your own items, and label them all on-screen. Abracadata Interiors D #09998 • Landscape D #09997 • Architecture D #09996

Sprout!

$34

Abracadata

Sprout! is the complete computer planning tool for vegetable gardeners. It lets you easily produce a graphic, scalable garden plan with correct plant and row spacing. In addition, Sprout! contains a fully editable database of vegetables for 7 climate regions. Print out garden layouts, calendars, shopping lists and reports.
Abracadata D #10794

NOW SHIPPING
WEEKDAYS TILL 2 AM E.T.

CODE #30304

At the Zone, *budget* is not a four-letter word.

The PC Zone™ Price, Availability and Service

Call 1•800•258•8088 > OPERATING SYSTEM KEY: W=Windows, D=DOS, B=Both

SOFTWARE

BUSINESS

W	10923	Act! for Win 1.0 Dual	$249
W	1[illegible]	ExeMaker Pr[illegible] for Win Dual	$268
D	09585	Harvard Graphics 3.0 3.5	$414
D	07865	Lotus 123 2.4 DOS 3.5"	$334
W	[illegible]	Lotus Organizer for Win Dual	$99
D	[illegible]	MS-DOS [illegible] pgr 3.5	$64
W	[illegible]	MS Excel 4.0 for Win 3.5	$299
W	10564	MS Office 3.1 for Win 3.5	$434
W	[illegible]	MS Word for Win 2.0 Dual	$298
D	11457	Paradox 4.[illegible] 3.5	$356
D	11327	PeachTree Complete Accounting 6.0 3.5"	$184
D	08557	WordPerfect 5.1 3.5"	$274

GRAPHICS

W	09058	Aldus Pagemaker 4.0 3.5"	$499
W	11562	Aldus Publishing Showcase for Win 1.0 3.5	$658
W	09014	Corel Draw 3.0 for Win 3.5	$389
W	11263	Fractal Design / Ace CAD Bndl Dual	$384
D	09528	FreeLance Graph 4.0 20034 5.25"	$328
D	07981	Presentation Task Force 4.0 Dual	$129
W	12036	The PrintShop Dlx for Win 1.0 3.5"	$48

UTILITIES

D	09896	Laplink Pro 4.0 Dual	$99
W	07834	Norton Desktop for Win 2.0 3.5"	$114
D	07780	Norton Util 6.01 3.5"	$114
D	09864	PC Tools 8.0 for DOS 3.5"	$132
W	11145	ProComm Plus for Win Dual	$94
D	09707	QEMM 386 6.02 3.5	$61
D	09651	Stacker 3.0 Dual	$99

HARDWARE

DISPLAY

B	07144	NEC Multisync 15 Monitor TFCX	$636
B	07143	NEC Multisync 15 Mon 4FG	$[illegible]
B	07399	NEC Multisync 17 Mon 5FG	$1,[illegible]
B	05123	SuperMatch 17 Multimode Clr	$[illegible]

ENHANCEMENTS

D	11288	Advanced Gravis Ultra Sound	$144
B	11891	ATI Graphics Ultra Pro w 2 MB	$556
B	11699	ATI Graphics Ultra W/1MB W. Free Stereo FX	$478
W	07866	Multisound for Win Dual	$[illegible]
D	07468	PNY 1MBx9 - 70ns for PC (Single)	$[illegible]
D	04228	PNY 1MBx9 - 80ns for PC (Single)	$[illegible]
D	07816	PNY 4MBx9 - 80ns (2 SIMMS per tube)	$[illegible]
D	10568	Pro Audio Spectrum 16	$[illegible]
D	09919	Sound Blaster Pro	$188
D	11204	Sound Blaster Pro Basic	$159
W	13728	Vid Blaster Bndl w Vid Kit	$344

INPUT

D	09522	Kensington Expert Mouse - Ser	$[illegible]
D	11324	Keytronic Trak 101 Trackball Kyb	$[illegible]
D	08620	MS Serial Mouse and Pad 2	$[illegible]
W	08310	MS Serial Mouse w/Win 3.1 Dual	$144

MODEM

D	09936	Hayes Optima 9k32 w/Sc Ez Ext	$[illegible]
B	00414	Supra Fax Modem V.32 BIS w/o 5ft Cable	$[illegible]
B	00424	Supra Fax Modem V.32 w/o 5ft Cable	$[illegible]

MULTIMEDIA

D	11240	Creative Labs Multimedia Upgr Kit Int	$564
D	07861	Creative Multimedia Upgr Kit Ext	$634
D	11205	DeskTop TV	$244
D	10567	Media Vision Multimedia MPC Upgr Kit Plus Int	$754
D	11530	NEC CD Express PC W CDR 25	$424
B	11537	NEC CDR 74 Ext CD ROM Only	$636
D	11538	NEC CDR 84 Int CD ROM Only	$544

POLICIES

- All major credit cards accepted. No surcharge.
- Credit card not charged until order is shipped. If we must ship a partial order, freight is not charged on back order (USA only).
- Most personal and company checks received by mail clear immediately. All checks or purchase orders must have a phone number and contact person listed. A $20.00 fee will be charged on all returned checks.
- C.O.D. orders accepted; limit $1,000 per order. Cashier's check or money order only. Add $5.00 per C.O.D. order.
- Educational, government and corporate purchase orders accepted.
- All U.S. shipments insured at no extra charge. All products covered by 120 day limited warranty.
- Add applicable sales tax; only in WA, OH.
- Prices and product availability subject to change without notice. All specials and promotions limited to stock on hand. Call for current prices.
- All shipments refer to "in stock" items; barring system failure, etc.
- Shipping: $6 per order for delivery in the USA via Airborne Express overnight service. (Some rural areas require extra day for delivery.) Canadian customer orders, in most cases, delivered within 24 hours. Call for complete information.
- **Orders placed by 2am ET weekdays ship that day.**
- **Orders placed Saturday ship to arrive Monday.**
- APO/FPO box orders shipped first class U.S. Mail. Shipments to P.O. Boxes via UPS.
- Competitive upgrades require proof of purchase of qualifying software.
- Not responsible for typographical errors.
- **Defective software replaced immediately. Hardware repaired or replaced at our discretion.**
- **Return Authorization Number must be obtained prior to returning any item. Call Customer Service Hotline 1-800-248-9948 weekdays 6am to 6pm PT.**

The PC Zone • 17411 NE Union Hill Road, Redmond, WA 98052-9964

International 206-883-3088 FAX 206-881-3421

©1993 Copyright Multiple Zones International, Inc. All rights reserved.

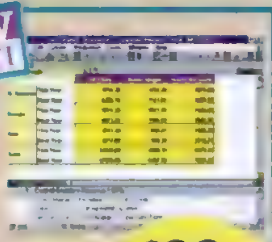
$218

Q+E Database Editor 5

Q+E Database Editor 5 is one of the easiest ways to move information from your company's databases to your desktop. It lets you create fill in the blank queries, design your own forms, build complex SQL statements and produce simple reports. Q+E Database Editor's point-and-click interface, pull-down menus, customizable icon bars and context sensitive help will make you productive in minutes. Pioneer Software **W #10991**

W #11437 Q+E Database/VB Add On ...$148

NEW PRODUCT



Improv for Windows

$98

It's the first dynamic spreadsheet for Windows—one look and you'll flip. Improv for Windows is a dramatic new approach to spreadsheet software, designed for anyone who needs to examine data from many different perspectives. Because Improv is so functional and flexible, it's the best tool to build worksheets you can share and expand on over time.

Lotus **W #12015 - 3.5" disk**

Lotus.

BORLAND

$488

dBASE IV 1.5

This is the worldwide standard in database management and application development from Borland. dBASE IV provides a comprehensive set of tools for organizing data into meaningful business information on both stand alone and networked systems. This powerful software is perfect for a wide range of database management needs. dBASE IV brings significant productivity gains to both users and developers. Users can perform database management tasks quickly and easily, without programming. Developers can use the automated development tools to build better applications faster, without sacrificing flexibility. And dBASE IV is built on a strong foundation—the dBASE language.

Borland **D #07843**

POWERFUL FEATURES MAKE dBASE EASY

- Access and manage your data on a single screen
- "Point and click" your way through all menus, windows and pop-ups
- Query, edit and link multiple files easily and quickly
- Up to 40 database files can be open simultaneously
- Comprehensive programming language for application development
- Control Center displays data information for easy use
- The worldwide standard for database management and application development
- From Borland, of course

CALL FOR YOUR FREE CATALOG 1•800•258•8088

NOW SHIPPING WEEKDAYS TILL 2 AM E.T.

CIRCLE 199 ON READER SERVICE CARD

CODE #30304

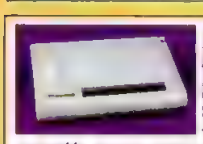
FASTMICRO DIRECT EXPRESS

PFS: Works for OS/2 $89

Jump start your computer with OS/2 and PFS: Works for OS/2. Together you will learn to use your computer like your desk. PFS: Works for OS/2 gives you a complete set of business applications for the OS/2 operating environment. Advanced word-processing, page layout, spreadsheets, charts and graphs, database, communications and labels in one easy-to-use package.

IBM OS/2 version 2.0 $139

Kodak Diconix 701 Printer $455



This new PC compatible, compact printer takes up less space on your desk top than a sheet of paper, yet provides full function capabilities. It consistently delivers crisp, 300dpi professional text and graphics for office-quality output.

AutoMap for Windows $55

Take the trouble out of road trip planning with this colorful, computerized road atlas for your PC. It has easy-to-read map displays and easy-to-follow trip instructions. Forget about fumbling with fold-out maps, and troublesome mileage charts, just tell AutoMap where you're starting, and where you want to go.

AutoMap DOS $49

AutoMap for Windows upgrade $45

Hitachi SuperScan 15 $499

A compact, high performance 15" monitor that is the perfect choice for windowing, business programs, presentation graphics and general applications. The advanced flat, square, anti-glare CRT technology is noticeably easier on your eyes. Automatically syncs at every graphic standard from VGA to 1024 to 768 .28 mm dot pitch.

SuperScan 17" $ 999

SuperScan 20" $1499

SureTrak $295

SureTrak helps you plan, schedule, visualize, and control your important projects. Its superb graphics help you plan the project, predict problems, analyze alternatives, and convey your recommended approach to team members and clients. Gantt and PERT charts, and precise resource and cost plans can be customized to make the perfect presentation.

HARDWARE

CD & MULTIMEDIA

Pinnacle Micro Internal CD ROM Drive $229

The Pinnacle Micro Internal CD-ROM drive uses standard 12cm CD-ROM disks. The drive assembly can sustain a raw data transfer of 4.3 Mbits per second of media. The drive includes supplementary audio outputs to play music and audio CD ROM disks. Package includes PC bus interface board which supports XT systems and above., and the World Atlas CD ROM

CD-ROM Software

Artshow by Corel	49
Baseball's Greatest Hit	49
BattleChess	45
Carmen SanDiego	59
Sports Illustrated Almanac	39
Book of Mammals	49
MS Multimedia Beethoven	55
MS Multimedia Bookshelf	129
PC SIG Shareware CD	99
U.S. Atlas w/ AutoMap	69
World Atlas	49

Microsoft Encarta $245

Encarta is a twenty-eight volume encyclopedia on CD-ROM with over 17,000 multimedia elements including pictures, anaimation and audio. Encarta features over 25,000 articles, samples 45 languages and much more!

CD-ROM Hardware

NEC Ext. CD Express w/CDR25	419
Pinnacle Internal CD-Rom w/Atlas	319
Sony Int. CD Drive Kit	349
ATI Stereo F/X	109
Creative Labs	
Multimedia Kit CD-ROM & SB Pro	559
Sound Blaster	95
Sound Blaster Pro (stereo & MIDI)	179
Video Blaster	319
Media Vision	
ProAudio Spectrum Plus / 16	179/197

DRIVES

Colorado	
DJ-10 40-120mb Int. Tape	199
DJ-20 80-240mb Int. Tape	259
External Kit w/AB11	99
Trakker 120 mb / 250 mb	359 / 439
DTC	
6282-24 24mbit/sec transfer rate	125
Maxtor	
7120A 120mb 15ms IDE	299
7213A 213mb 15ms IDE	399
Micropolis (see DTC Controllers)	
MC1664 345mb HH ESDI 14ms	899
MC1568 668mb FH ESDI 14ms	1279
Plus Development	
HardCard IDL 50mb 9 ms 16bit	249
HardCard IDL 105mb 9 ms 16bit	399

DRIVES CONT.

Quantum	
LPS52A 52mb 16ms IDE	199
LPS120A 120mb 16ms IDE	309
LPS240A 240mb 16ms IDE	579

Teac 1.44mb 3.5" or 1.2mb 5.25" Floppy Drive $59

Genuine Teac quality at a low price, these high density floppy drives also read, write & format low density floppy disks. They work great with all true 286, 386 & 486 compatibles. 1.44 mb 3.5" drive includes mounting kit and bracket. For rails for 1.2mb 5.25" drive, add $5.

Seagate	
40MB ST351A 28ms IDE Drive	159
105MB ST3120A 19ms IDE Drive	249
125MB ST3144A 19ms IDE Drive	299
245MB ST3283A 12ms IDE Drive	549
425MB ST1480A 14ms IDE	879
1.42GB ST41650N 15ms SCSI	1899
Teac	
1.2MB 5.25" Floppy	59
1.44MB 3.5" Floppy	59
Toshiba	
360K 5.25" Floppy (Black)	59
1.2MB 5.25" Floppy	59
1.44MB 3.5" Floppy	59
Western Digital	
WDAC280 80mb IDE 20ms	239
WDAC2200 200mb IDE 20ms	399

MODEMS

ATI	
2400 ETC V.42 Int. / Ext.	69/95
9600/E External MNP V.42bis	279
Best Data Traveler 9624FP	109
Everex 2400B Int Modem	69
Hayes	
Optima 24 + Fax96	149
Optima 96 + Fax96	369
Ultra 144 Ext.	669
Pocket Edition 2400 Modem	119
Intel	
Classic 2400 Modem Int./ Ext	139/159
Satisfaxtion Int. 100/ 200	99 /299
Practical Peripherals	
2400B Int Modem Std/MNP	79 /119
PM9600SA Int. / Ext.	279 /299
PM14400FX Int. / Ext.	379 /419
USRobotics	
9600 Sportster Int / Ext.	279/299
Courier HST 14,400 Int. / Ext.	539 /559
Courier HST 14,400 Dual Std Ext.	799
ZOOM	
14.4 Int. / Ext.	229/269
2400b Internal Modem	59
9624 Send/Receive Int Fax Modem	79

Optima 9600 $369

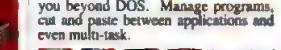
Hayes quality and affordability in this V.32 9600 bps modem. V.42bis boosts throughput to 38,400 bps. It also includes V.42 & MNP 5 error correction and automatic feature negotiation for the most efficient performance.

MICE & INPUT

Key Tronic 101 Keyboard	59
Logitech	
Mouseman Serial righthand	65
Mouseman Bus righthand	65
Mouseman Cordless	85
FotoMan	499
ScanMan 32	139
ScanMan 32 w/ Catchword	179
ScanMan 256	259
ScanMan 256 w/ Catchword Pro	299
Trackman 9/25	75
Trackman Portable	95
Microsoft	
Serial or Bus Mouse only	83
Serial with Trivial Pursuit	75
Ballpoint	119

Dexxa Mouse with Windows $57

The affordable, high-quality DEXXA Mouse and Microsoft Windows 3.1 combination takes you beyond DOS. Manage programs, cut and paste between applications and even multi-task.



Epson Action Laser 1000 $679

Epson's newest laser printer offers outstanding value and performance to entry-level laser printer buyers. The Action Laser 1000's innovative, compact design can print 6PPM with 14 bit mapped fonts. HP IIP, FX and LQ emulation, and come with 512K of memory expandable to 6.5mb. Optional serial, parallel, Appletalk, twinax and coax interfaces, with automatic interface sensing and emulation switching.

Action Laser 1500 $849

NETWORKING

Artisoft/Lantastic	
Lantastic for Windows	165
Lantastic 2 Station Ethernet Kit	489
Ethernet Additional Stations	209
Eagle	
NE2000 2 Station NW Lite Kit	419
NE1500 16 Bit 10baseT Adapter	149
FastData NE2000 16 Bit 10-BaseT	109
Intel EtherExpress 16 or 16TP	129
Novell Netware Lite 1.1 w/ DR DOS	65

VIDEO & MONITORS

ATI	
Graphics Vantage 1mb	219
VGA Basic 16 / Integra	65 /79
VGA Wonder XL24 1mb	149
Graphics Ultra Pro 1mb/2mb	449/529
Diamond	
SpeedStar24X 16 Million Colors	159
Stealth VRAM HiColor 1mb	219
MAG Colorview 15 / 17x17	599/1099
NEC	
Multisync 3FGX	669
Multisync 4FG	799
Multisync 5FG	1399

FastData PowerWin VGA $99

Run Windows six times faster than ordinary VGA! This 1mb VGA card features an ET4000 accelerator chip, maximum 1024x768 resolution, and standard 16 bit ISA compatibility. It also includes a Sierra RAMDAC chip which allows it to display 65,536 colors at the 800x600 mode.

Hitachi	
SuperScan 15	499
SuperScan 17	999
SuperScan 20	1499
Orchid	
ProDesigner II 1mb	199
Farenheit 1280s HiColor	299
Panasonic C1381 SVGA	329
Radius Color Pivot w/ Card	1099
Seiko CM1450	439
Sony 1304S Multiscan	599
Video 7	
WIN.VGA 512K/1MB	139 /169
V-RAM II Ergo VGA 1mb	319

CHIPS

Acculogic	
RAMpAT!	119
RAMpAT! Plus	145
Cyrix	
FasMath387DX 40	119
FasMath387SX	75
Intel 287XL	79
387-DX	85
387-SX	79
Overdrive486SX 25	499
Overdrive486DX 33	659
Memory - 1mb SIMMS 80ns	45

PRINTERS

Canon	
BJ10EX Portable	319
BJ300 / BJ330 Ink Jet	459 / 599
Citizen	
200GX 9 Pin	159
GSX-140+ 24 Pin	295
GSX-145 24 Pin Wide	369
PN48 Std / Pro	299 /329
GSX-230	259
GSX-240	339
Co Star LabelWriter II/Plus	179 /289
Epson	
Action 3250	199
Action Laser 1000/1500	679/849
Memory Products	
HP II, IIP, or III 1/2mb Upgrade	99/129
OKI 400 1/2mb Upgrade	129/189
Pana. 4420, 4450i 1/2mb Upg.	119/169
NEC	
Silentwriter 2 Model 95	1444
Okidata	
Okilaser 400	599
Okidata ML 380	239
Panasonic	
KXP1180 9 Pin	149
KXP1123 24 Pin	199
KXP1124i High Speed 24 Pin	279
KXP1624 24 Pin Wide	339
KXP2180 Quiet 9 Pin	179
KXP2123 Quiet 24 Pin	259
KXP2124 Quiet 24 Pin	329
KXP21XX Series Color upgrade kit	59
KXP2624 High Speed Quiet 24 Pin	399
KXP4410/4430 Laser	649/899
KXP4450i Laser	1069
KXP4455 Laser	1699

Panasonic 4410 Laser $649

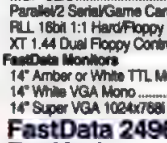
The Panasonic KX P4410 includes 5 PPM, HP IIP emulation, a large 200 sheet paper tray and 28 standard fonts. It works with all current major software programs, has 512K of upgradable memory, and has an EZ-set LCD panel.

QMS PS410	1599
Seiko	
Smart Label Plus	139
Smart Label Plus Win. & DOS	175
Star NX1001	139
Taxan Instruments	
Microlaser Plus PS17	1199
Microlaser Plus PS35	1349
Microlaser PS35 Turbo	1599

FASTDATA PRODUCTS

FastData Boards	
16bit 1mb VGA	89
16bit 256K VGA	45
2400B Internal Modem	49
9600B Send/Rec. Fax w/2400B	69
CGA Card	35
Ethernet 16bit 10Base-T	109
IDE 16 Bit Hard/Floppy Disk Cont.	29
IDE HD/FD w/Par/2 Serial/Game	39
MGP Card	29
Parallel/2 Serial/Game Card	29
RLL 16bit 1:1 Hard/Floppy Disk Cont.	69
XT 1.44 Dual Floppy Controller	35
FastData Monitors	
14" Amber or White TTL Mono.	99
14" White VGA Mono	119
14" Super VGA 1024x768i .28 dp.	299

FastData 2496 SR FaxModem $69



A great value, the FastData 2400 baud internal modem with 9600 send and 4800 receive fax works with all industry standard PC's and includes BitFax software, and is configurable from COM 1 - COM 4.

FASTMICRO DIRECT EXPRESS

Ordering Information

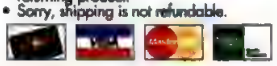
- No Charge for Visa, MasterCard, Discover Card or American Express.
- Purchase orders accepted (no surcharges) from approved corporations only.
- Minimum phone order: $50.
- Prices/availability subject to change.
- Sorry, no COD's.
- AZ orders add 6.7% tax.

Shipping Information

- All orders up to 20 pounds are shipped via Airborne Express.
- Shipping & handling charge: 3% (Min. $6).
- AK, HI, & APO addresses add $15 per box.
- Personal/company checks delay shipping.
- International orders: Fax 602-437-8622 for shipping costs before ordering.

Returns & Warranty Information

- Product warranties, offers & claims are handled by the manufacturer (all FastData branded products are warranted through FastMicro).
- Compatibility is not guaranteed (except on FastData products).
- No returns on used items (except FastData branded products).
- All opened returns are subject to 15% restocking fee (except FastData branded products).
- DOA's repaired or replaced at our option.
- Call for return authorization (RA) before returning product.
- Sorry, shipping is not refundable.



Mailing Address
FastMicro, Inc.
4405 E. Baseline Road
Phoenix, AZ 85044
To place orders call: 800-441-3278
For customer service call: 602-431-8100
Canada/Local call: 602-431-8200
FAX: 602-431-8300

We Ship Air at Ground Rates.

0393

CALL OUR TOLL-FREE ORDER LINE: # 1-800-441-FAST

SOFTWARE

= Windows Software

Microsoft Sound System

$219

The Microsoft Windows Sound System lets you access the rich audio features of the windows operating system version 3.1, and adds many more integrated features of its own. Give your PC voice commands! Package contains software, audio card, microphone and headphones.

DATABASE & FORMS

askSam 5.1	209
Clarion Personal Developer	45
Clarion Professional Developer 3.0	449
Clipper 5.01	489
DataEase	509
dBase III+	439
dBase IV 1.5	499
w DBfast for Windows	329
dBXL V	129
FormTool Gold	52
Formfiller	79
w FormWorx for Windows	99
Foxbase Plus	279
FoxPro DOS / Windows	339/Call
Paradox 4.0	519
Paradox Version Upgrade	179
Paradox SE	65
Per:Form Designer & Filler	89
w Per:Form Pro	179
Personal Rbase	69
Q & A 4.0	249
Rbase 4.0	447
Reflex	159

FINANCIAL CONT.

ACCPAC BPI Value Pak	359
ACCPAC Simply Accounting DOS	119
w ACCPAC Simply Acctg Windows	119
DAC Accounting 4 3	85
DAC Bonus Pack 4.3	119
DAC Easy Instant Accounting	35
Managing Your Money	47
w Microsoft Money for Windows	15
w Microsoft Profit	135
w M.Y.O.B.	129
One Write Plus G/L, A/P & A/R	79
Pacioli 2000	29
Peachtree Basic Acctg.	69
PeachPay	49
w Peachtree Acctg for Windows	89
Peachtree Complete 6.0 (with DQ)	169
Peachtree Network Accounting	279
w Quicken for Windows	45
Quicken DOS 6 0	45
QuickBooks	85
QuickBooks with QuickPay	109
Wealth Builder	89
w Adobe Illustrator 4 0	359

GRAPHICS

Autosketch 3 0 DOS/Windows	139/169
w Corel Draw! 3.0	369
Design CAD 3-D	235
DrawPerfect	259
w Freehand	389
Freelance Graphics 4.0	299
w Freelance Graphics for Windows	339
Freelance Competitive Upgrade	89
w Hollywood	299

PROGRAMMING CONT.

MS Quick Basic	60
MS Quick C DOS	60
w MS Quick C Windows	125
MS Quick Pascal	60
Turbo C++ DOS	69
w Turbo C++ Windows	99
Turbo Pascal DOS	99
w Turbo Pascal for Windows	119
Visual Basic for Windows	125

SPREADSHEETS

1-2-3 version 2.4	325
1-2-3 version 3.4	399
w 1-2-3 for Windows 1.1	319
w 1-2-3 Competitive Upgrades	99ea

QuattroPro for Windows $95

Built with Borland's innovative object-oriented technology, Quattro Pro for Windows is packed with revolutionary new features, including Spreadsheet Notebooks to manage and organize your work, and built-in push button power with intelligent graph system. Take advantage of special pricing for a limited time.

Always	115
w Excel 4.0	299
w Excel 4 0 Competitive Upgrade	119
w Quattro Pro WinDOS	299
w Quattro Pro WinDOS Upgrade	139
Quattro Pro SE w/ Training Video	65
w Quattro Pro Windows Upgrade	89
Supercalc 5.5	89

WORD PROCESSORS

w Ami Pro 3.0	239
w Ami Pro 3.0 Comp./Vers. Upgr.	95/65
w CA-Textor	83
w Correct Grammar	57
Facelift for WordPerfect	57
w Grammatik IV for Windows	55
Grammatik V	55
w JustWrite 2.0	159
LetterPerfect	85

WordPerfect 5.2 for Windows $249

The #1 Word Processor for Windows! WordPerfect 5.2 for Windows includes new features such as Grammatik 5, Mail Enabled, Quick Finder, ATM and Object Linking & Embedding. Upgrade from WP for DOS for $79

w WordPerfect for Windows	249
Microsoft Word for DOS	209
w Microsoft Word for Windows	299
w Pro Write Plus	159
Multimate 4.0	239
PC Write Standard Level	59
Professional Write	159
Rightwriter DOS 6.0	59
w RightWriter for Windows	59
WordPerfect 5.1	249
w WordPerfect for Windows 5.2	249
w WordPerfect DOS to Win. Upgrade	79
WordPerfect Add'l Staion License	159
WordPerfect Office	89
w WordStar for Windows	89
WordStar Pro	259
Writer's Toolkit DOS/Windows	79/79

UTILITIES - DOS

386 MAX	59
Address Book Plus	55
Calendar Creator Plus	47
Carbon Copy Plus	125
Central Point Anti-Virus	89
Central Point Backup	89
Checkit	79
Compuserve Membership	29
Desqview 2.4	75
Desqview 386 2.4/6.0	125
Direct Access	57
Disk Manager Dos / Novell	36 /119

UTILITIES - DOS CONT.

Disk Optimizer	29
DR DOS 6.0	65
DosFax Pro	49
Fastback Plus	119
Hijaak	125
InfoSpotter	45
Labels Unlimited	59
Laplink Pro	85
Laplink Pro 4.0 Version Upgrade	55
Microsoft Learning DOS	32
MS-DOS 5.0 Upgrade	59
Norton AntiVirus	79
Norton Backup	89
Norton Desktop for DOS	109
Norton Utilities	109
OS/2	139
PC Anywhere IV	100
PC Tools Deluxe 8.0	119
P.D Queue	55
Pop Drop Plus	53
PrintRite	19
ProComm Plus	65
Prodigy	25
QA Plus	85
QEMM 386 6.0	57
QRAM 2.0	49
SideKick 2.0	59
Sideways	55
Smartcom Exec	69
SpintRite II	69
Stacker	89
Super PC Kwik	55
XTree Gold 2.5	89

UTILITIES - WINDOWS

Wired for Sound Pro $39

This Windows utility for your sound card has 200 realistic sounds. Add personality by attaching sounds and voices to any Windows application, message, icon, or dialog box. The Talking Alarm Clock and Talking Calendar tell you where to be and whom to see. You also get 400 ICONS that talk, 100 cursors, Talking Calculator, Talking Solitaire, Minesweeper, 10 video screen savers, and four other great programs. For sound without hardware ask for Wired for Sound 2.0. Call 800-551-4547 for a live demo then call FastMicro to order.

w Adobe Type Align	59
w Adobe Type Manager	59
w Adobe Type Manager Plus Pack	115
w After Dark for Windows	25
w BeckerTools	37
w Bitstream MakeUp	89
w BitFax & BitCom	89
w CA-Up To Date	89
w CA-SuperProject for Windows	519
w Direct Access Windows	60
w Hijaak	125
w Lotus Organizer	89
w MicroPhone II	89
w Microsoft Mouse w/ Windows 3.1	147
w Microsoft Productivity Pack	39
w Microsoft Project for Windows	429
w Microsoft TrueType Font Pack	39
w Microsoft Windows 3.1	89
w MediaBlitz!	69
w Multimedia Make Your Point	73
w Norton Backup	95
w Norton Desktop	109
w On Target	239
w PackRat 4.1	239
w ProComm Plus for Windows	95
w Stacker for Windows	89
w WideAngle for Windows	59
w Winconnect	59
w WinFax Pro	79
w XTree	Call

Visio $195

Visio is the first product designed to solve the drawing requirements of non-artist business, technical, and administrative professionals. Its intuitive "Drag and Drop Drawing" approach enables quick creation of drawings and diagrams. Drawing is as simple as clicking on shapes and dragging and dropping them into place. With 17 job-specific stencils and over 300 SmartShapes, Visio makes drawing an everyday activity.

DESKTOP PUBLISHING

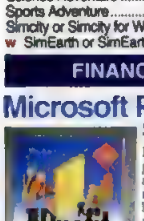
Bannermania	21
Express Publisher DOS / Win	99/99
w Microsoft Publisher	129
w Pagemaker	489
w PFS: Publisher	89
Printshop	33
Printshop Deluxe	49
Publish It!	89
w Ventura Publisher for Windows	499
Ventura Database Publisher	179

ENTERTAINMENT

AutoMap U.S.A./Europe	49/75
Chemistry Works	39
BodyWorks / Orbits	39 /29
Carmen SanDiego Deluxe Edition	45
F-19 Stealth Fighter	36
Falcon 3.0	45
King's Quest 5 (VGA Vers.)	38
Leisure Suit Larry V	39
w Microsoft Ent. Pack I, II, III or IV	27
Microsoft Flight Simulator	38
Aircraft & Scenery Designer	27
w Microsoft Golf	47
PC Globe or PC USA	35
Science Adventure	53
Sports Adventure	41
Simcity or Simcity for Windows	28
w SimEarth or SimEarth for Windows	39

FINANCIAL

Microsoft Profit $135



Microsoft Profit gives you instant access to business information to help you run your growing company. Profit even handles the accounting, so you don't need to know accounting to keep track of your books. Just choose one of the common business using reports and Profit Signs. Let Profit keep track of your accounting, so you can do what you know best: manage your business and make a profit.

Generic 3D Drafting	199
Generic CAD Level 2 Starter Kit	85
Generic CAD 6 0	279
Harvard Graphics DOS	379
w Harvard Graphics Windows	339
w Micrografx Designer	389
w Microsoft Powerpoint	309
PC Paintbrush 5+	109
w Persuasion	319
w Publisher's Paintbrush	319
w Windows Draw	89
WordPerfect Presentations	

INTEGRATED

First Choice	95
Framework XE	95
Geoworks Pro	115
LotusWorks	89
w Lotus SmartSuite	449
w Microsoft Works for Windows	129
w Microsoft Office	447
w PFS WindowWorks	73
SmartWare II	417
Symphony 3.0	489
MS Works 3.0	89
Works w/ MS Serial Mouse	149

Lotus SmartSuite for Windows $449

SmartSuite includes full-featured Lotus applications including: 1-2-3 for Windows, AmiPro for Windows, Freelance Graphics and cc:Mail. SmartSuite offers easy consistent installation, menus, displays and help tools.

PROGRAMMING

w Asymetrix Toolbook	279
Borland C++	325
w Borland ObjectVision	105
MS Macro Assembler	95
w MS Windows Software Dev Kit	229
w MS Windows Device Drivers Kit	319
MS C/C++ 7.0 w/ Win. SDK	299
MS C/C++ 7.0 Vers. Upgr.	139

Ami Pro 3.0 $239

The unique, Windows-based design of Ami Pro 3.0 puts a world of creative power right at your fingertips. Create a frame for text or graphics. Copy and apply text attributes with Fast Format. Print an envelope. Import a picture. All it takes is click of the mouse. Whether you create basic letters and memos or complex documents with charts and graphics, Ami Pro 3.0 will make your word processing work dramatically easier,and your output better looking than ever. So you can create letter perfect, picture-perfect documents in half the time, with half the effort.

After Dark for Windows & Star Trek: The Screen Saver

From the makers of the #1 best selling screen saver comes Star Trek The Screen Saver. Beam Aboard the Star Ship Enterprise with Captain Kirk, Mr. Spock and all your favorite characters on a mission to prevent damaging phosphorous screen burn-in

Star Trek: The Screen Saver	$32
After Dark for Windows	$25

Software Marketing Corporation

Astrology enters the computer age with Zodiac Signs, the newest product from SMC. For the science enthusiast, Chemistry Works makes learning about chemistry fun! Take a voyage through the solar system with Orbits, and go far beyond our world into the incredible wonders that fill our heavens. Or, take an adventure in human anatomy with BodyWorks

Zodiac Signs	$35
Chemistry Works	$39
Orbits	$35
Body Works	$39

Paradox for Windows $125 Special Introductory Price

Paradox for Windows is the new relational database product from Borland that makes powerful database features easy to use. It includes a full set of graphical tools including object Inspector Menus Query by example (QBE) interface, SpeedBar Icons, Visual Form and Report Designers, built -in Productivity Experts and more, to get you up and running fast. Quantities limited at this price

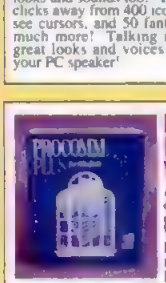
Lotus Organizer $89

Lotus Organizer is the personal information manager for windows that includes calender, to-do list, planner, address book, note pad and anniversary. With its traditional notebook format, Organizer feels like an old friend right from the start. The six tabbed notebook sections are easily customized and work together to help you organize your schedule, prioritize task, contact clients and just get more done!

Talking Icons $29

Your Windows desktop deserves a make over with Talking Icons! Within a few short minutes you'll show off Windows good looks and sounds too! You're only a few mouse clicks away from 400 icons that talk, 100 easy to see cursors, and 50 fantastic sound effects and much more! Talking icons gives your icons great looks and voices that jump right out of your PC speaker!

Procomm Plus for Windows $95



A powerful, easy to use communication software package for Microsoft Windows. ProComm Plus for Windows has 34 terminal emulations with keyboard remapping, several error correcting file transfer protocols, filename clipboard, advanced host mode for unattended remote access with electronic mail and file transfers. It has a automated dialing directory, ASPECT and mouse support

CIRCLE 352 ON READER SERVICE CARD

How PC Direct Helped Computer Discount Warehouse Found "Customer University"

All the employees at the Computer Discount Warehouse are still in school. No, they're not teenagers anymore, but they're all enrolled in a program called CDW University—which they also call "Customer U."

"We believe that the only way to grow is to make the customer #1," says Michael Krasny, the company's CEO. "That's why we established an on-going, mandatory training program that focuses on customer service and product briefings. Our employees also have personal, hands-on experience of a lot of the products they sell—and they know how to treat the customer right."

The customer support program at CDW, a ten-year-old reseller of PC hardware and software, includes free technical support from 8 a.m. to 7:30 p.m. "We guarantee that support calls will be answered within three minutes," says Krasny. He also points out that a $10 million product inventory makes it possible for the company to provide same-day order shipment.

Computer Discount Warehouse has turned their success into an opportunity to offer better customer service, and Krasny singles out his advertising in PC Magazine as the cornerstone of his success. "We've been in the PC Direct section since 1986, and we've never missed an issue. Our most loyal customers, the ones who appreciate service, come to us through PC Magazine. No matter how you look at it—closing rate, calls per ad dollar—PC Magazine is tops."

If you're a direct marketer and you're looking for one million prospects who understand value and service, look no further than PC Direct. There's no better way to attract so many loyal, repeat customers.

PC DIRECT

The Purchasing Source for Direct Buyers

MEMORY!

H. Co. has America's largest selection of memory!

*And, we'll beat any USA advertised price.**

Memory is Cheap-but Only if you Know Where to Look. The Phantom Saves a Bundle on SIMMS. Truth in advertising–what a concept...

PC Computing, April 1992

Math Coprocessors

IIT

Part #	Price
[illegible] 16	80.00
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
3C87-40	119.00

intel

Part #	Price
80487SX-25 o.drive	$509.00
80487SX 16/20 o.drive	409.00
80387-33 (w/ 386DX)	95.00
80387SX (w/ 386SX)	90.00
80387SL (w/ 386SL)	95.00
80287 XL/XLT	83.00

Cyrix

Part #	Price
82S87S-20	$80.00
83S8725	85.00
83D87 25	95.00
83D87 33	95.00
83D877-40	129.00

We Carry all overdrive processors!

Laptop Memory

TOSHIBA

	Memory Added	Price
T1000SE/XE/LE		
	2MB	$95.00
T2000SX/SXE		
	4MB	195.00
	8MB	355.00
T3100SX T3200SX/SXL		
	2MB	89.00
	4MB	159.00
T1200EX,T1600,T3100E		
	2MB	89.00
T3200	3MB	149.00
T5100	2MB	89.00
T5200,T5200C,T8500SL		
	2MB	89.00
	8MB	319.00
T3100	2MB	189.00
T4400,T6400,T3300SL		
	2MB	139.00
	4MB	269.00
T3300SI	6MB	395.00
T4400 T6400	8MB	549.00

IBM

	Memory Added	Price
L40SX	2MBMem	$109.00
	4MB mem	139.00
	8MB Mem	299.00
[illegible]	2MB Mem	145.00
NEW	4MBMem	245.00
	8MB Mem	475.00

COMPAQ

	Memory Added	Price
Portable III	2MB Mem	$129.00
Portable 386/20		
	1MB kit	179.00
	4MBEXP	459.00
Portable	1MB BD	119.00
LTE 286	2MB BD	99.00
	4MB BD	89.00
Portable	1MB BD	179.00
LTE386S/20	1MBBD	89.00
	4MB BD	219.00
SLT/286	1MB BD	79.00
	4MB BD	289.00
SLT/386		
	2MB BD	169.00
	4MB BD	219.00

NEC

	Memory Added	Price
UltraLite	1MB BD	$129.00
286F	4MB BD	295.00
Prospeed	1MB BD	129.00
SX/20	4MB BD	295.00
Prospeed 286	1MB BD	99.00
386SX/16	2MB BD	219.00
	4MB BD	299.00
Ultra Lite II	2MB	159.00
	4MB	319.00
NEW	8MB	599.00
UltraLite SI/20		
NEW	2MB	159.00

ZENITH

	Memory Added	Price
SuperSport/SX		
	2MBAlpha	$139.00
	2MB Beta	139.00
	2MBEXP	149.00
Slimsport	2MB CD	119.00
286e	4MB CD	269.00
Tubosport	1MB BD	89.00
386e	4MB BD	269.00
Mastersport SX/SL		
	2MB	109.00
Z Note	2MB	159.00
	8MB	479.00

OTHERS

	Memory Added	Price
AST Ext	1MB SIMM	$59.00
Notebook	4MB SIMM	149.00
Sharp		
PC 6620	1MB BD	129.00
TI TM 2000	1MB BD	99.00
TI TM 3000	2MB Kit	89.00
TI TM 4000	4MB	209.00
Everex T LX	2MB MD	99.00
Panasonic CF 170 270 370	1MB CD	69.00
Epson	1MB UPG	99.00
Tandon 386	8MB	299.00

Desktop Memory Upgrades

Apple

	Memory Added	Price
Mac Classic	1-3MBBD	$79.00
	2MBKit	79.00
Mac IIci,IIsi	1MB Kit	129.00
Mac IIsi	2MB Kit1	49.00
Mac IIci,11si	4MB Kit	179.00
Mac IIsi	8MB Kit	399.90
Mac IIci,IIsi1	6MB Kit	569.00
Mac IIfx	4MB Kit	189.00
	16MB Kit	599.00
Mac SE,SE 30, Plus, II, Icx,IIx	4MB Kit	179.00

AST

Memory	Price Added	
Bravo 486/25		
	2MB Kit	$109.00
	8MB Kit	298.00
Prem 386/SX-16 & 20 25 33		
	8MB Kit	298.00
Prem II SX		
	1MB	55.00
SX/16	4MB Kit	149.00
Cupid Exp	OK BD	179.00
Premium	1MB Ki	59.00
386C		
WKST & Bravo Premium286	4MB Kit	189.00
Fastram	512-2MB BD	289.00
Fastram Kit		
	512 UPG	55.00
Premium	1MB Kit	59.00
386	4MB Ki	229.00

COMPAQ

	Memory Added	Price
Dp 386	2MB MD	$119.00
33, 486/25, 33 &		
Sysptem	8MB BD	319.00
DP 386	1MB BD	119.00
20e, 20 & 25e, 25		
	4MB BD	269.00
	1M BD	89.00
	4MB BD	169.00
DP 286N,	1MB MD	59.00
386N, & 386SX/20		
	2MB MD	99.00
	4MB MD	179.00
	OK BD	89.00
DP 386/16		
	1MB BD	239.00
	4MB BD	479.00
	8MB BD	799.00

IBM

Works	w/Model	Price
50Z,55SX,70-E61 70-121,P-70	1MB	$50.00
50Z,55SX,70-E61, 70-121,-70	2MB	80.00
55SX,65SX,55LS, 34F3077	4MB	139.00
7-0-A21,A61,B21 B61	2MB	80.00
30/286	2MB	80.00
PS/1	2MB	90.00
80-041	1MB	79.00
80-111,31	2MB	99.00
80-A21,A31,A61	4MB	149.00
90,95	4MB	149.00
70,80	MB BD	279.00
50 & 60 Series	2MB BD	259.00
PS/2 Model 57SX, 90, 95	8MB MD	329.00

CALL FOR RISC SYTEM 6000 MEMORY!!

NEC

	Memory Added	Price
P.M. SX	1MB BD	$169.00
Plus	4MB BD	399.00
	8MB BD	719.00
P.M. SX/20	2MBCPU	179.00
	UPG. 2MB	239.00
	UPG. & EXp. 2MB	79.00
	UPG Kit	
P.M. SX/16	2-8MB Exp	189.00
	2MB	79.00
	UPG. Kit	
P.M. 386/20	2MB MD	299.00
	8MB MD	699.00
P.M 386/25S	2MB MD	299.00
	8MB MD	699.00
	8MB	999.00
	Repl BD	
P.M 386/33E & 486/25E	2MB MD	199.00

ZENITH

	Memory Added	Price
Z-386/20, 25, 33, 33e	1MB SM	$59.00
	2MB SM	99.00
	4MB SM	159.00
Z-386SX 286 LP+ Z-LS	2MB SM	89.00

We Support Fully Compatible MEMORY For Most PC's AND LASER PRINTERS At The LOWEST PRICES!

Laser Printer Memory

Model	Memory	Price Added
H.P. Laserjet IIP, III, IIID, IIIP, II, IID	2MB Module	$105.00
	4MB Module	165.00
H.P. Laserjet IV	2MB Module	95.00
	4MB Module	155.00
	8MB Module	305.00
H P Deskjet	256K Module	59.00
IBM 4019, 4019e	2MB Module	119.00
	3.5MB Module	189.00
IBM 4029	4MB Modlue	209.00
OKI Laser 800, 820	2MB Module	129.00
	4MB Module	199.00
Panasonic 4410, 4420, 4430 & 4450i	2MB Module	109.00
	4MB Module	199.00
Epson EP8000	2MB Module	109.00
	4MB Module	179.00
Espn Action Laser II	2MB Module	149.00
	4MB Module	229.00
TI M[illegible] XL	1MB Module	59.00

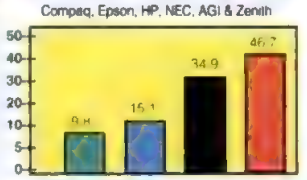
SPECIALS!

1X9-70 (3Chip)	$32.00
1X9-70 (9Chip)	36.00
4X9-70 (9Chip)	125.00
1X8-70 (For Mac)	34.00
4X8-80 (8Chip)	115.00

Now Shipping **KINGSTON**

Convert your 286 to a 386

The SX/NOW Works with: IBM, AST Compaq, Epson, HP, NEC, AGI & Zenith



25Mhz	$275.00
33Mhz	300.00

KINGSTON now shipping 486 upgrade for Compaq 386-16, 20, 20e, 25, 25e 33 & IBM PS2, 70 & 80

486SX-25	$450.00
486-33	825.00

All Products 100% Guaranteed!

PURCHASE ORDERS ACCEPTED

H.Co Computer Products, Inc
17922 Sky Park Circle #F
Irvine, CA 92714
Office 1-714-833-3222
Tech Support 1-714-833-3364
FAX 1-714-833-3389

"Your #1 Choice for Memory Upgrades."

1-800-726-2477

CIRCLE 391 ON READER SERVICE CARD

"Order by 4 o'clock (PST) Guaranteed We'll Ship Today!"

OPEN WEEKENDS

TERMS:

1 PO's accepted from universities, government agencies & qualified firms.
2 VISA MC AMEX C.O.D. pre-paid & approved PO's only please!
3 FAX orders accepted. International orders accepted.
4 15% Restocking fee on returns within 30 days. No refunds after 30 days.
5 No Software returns.

VISA MasterCard

*Any legitimate advertised price from companies with new merchandise actually in stock. Due to I.T.C. tariffs placed on Korean manufacturers, memory pricing may be higher than advertised. H.Co. same day shipping guarantee applies only if parts are in stock. Offer excludes Chips and SIMMS. Trademarks are the property of their respective companies. Prices are subject to change without notice. 1992 H.Co. Computer Products, Inc. 12/15/92 PCM

We're Having A "FREE For ALL"!

- **FREE** Ground Shipping
- **FREE** Air Shipping – order 5 or more products
- **FREE** Catalog
- Toll - **FREE** 800-FAX line
- Toll - **FREE** 800-Sales & Service
- Hassle - **FREE** 150-day return policy
- Open All Day – 7 Days – We're **FREE** when you're **FREE**
- Customer Showroom
- Lowest Discounted Prices
- Corporate Government PO's accepted
- Over 10,000 Items available

PRESENTATION TASK FORCE 4.0 #126

"The best CGM clip art for overall quality and usability ..." say PC Magazine. The ONLY clip art with over 3,500 color illustrations.

CA-ACCPAC BPI INTEGRATED ACCOUNTING #339

Now you can buy this all NEW all-in-one AccPac BPI industry standard accounting system including GL, AR, AP, IC, OE, Payroll and LAN PAK (40 users) for one incredible low price.

CA-CLIPPER COMPETITIVE UPGRADE 5.2 #195

Trade in any database and receive the newest version of CA-Clipper for an incredible price.

WORDPERFECT FOR WINDOWS 5.2 #256

Wordperfect for Windows takes advantage of the Windows GUI. Adjust margins, set tabs, change line-spacing with the buttonbar and ruler. Create and modify columns and tables easily

DESIGNCAD PRO SERIES #535

The Pro Series combines Designcad 2D, Designcad 3D, Scanpro, 6700 symbols, Smart EST-job estimates and 3 instructional videos.

DOS

ACCOUNTING

Access to Platinum-DOS
Amortizer Plus
Businessworks Bundle
CA-Accpac IC, OE, Pay, etc.
CA-Accpac BPI Integrated
CA-Accpac Simply Accounting-DOS
DAC Easy Acctg / Payroll #7 / #8
DAC Easy Startup Pak #10
DAC Easy Point-Of-Sale #9
DAC Easy Instant Acctg.
Managing Your Money
Money Counts
One Write Plus Accounting
One Write Plus Vendor
Pacioli 2000 2.0
Peachtree Complete Accounting
Peachtree Payroll Pak
Quickbooks / Quickpay
Quicken 6.0
Timeslips 5
Turbo Tax DOS

CAD

Autocad Simulator
Autodesk 3D Connects
Autodesk 3D Plan
Autodesk Animator
Autodesk Desk
Autodesk Hooks
Autodesk 10Utilities
Autodesk Lisptrainer
Autodesk Office Series: Office Layout
Autovision
DesignCAD 3D v.4.0
DesignCAD 3.0
DesignCAD 3D/DesignCAD Lib.
DesignCAD Prof. Series
Generic CADD 6.0
Multicad 2.5
Turbo CAD

CD ROM / MULTIMEDIA

Birds of America
CD Speedway
Companions Family Steps
Compton's Encyclopedia
Corel Artshow
Corel Draw 3.0
Countries of the World Envy.
Creative Labs Upgrade Kit
Desktop PC
Grolier's Encyclopedia
Multimedia
Miracle Piano Teaching System
MS Bookshelf
MS Bookshelf
MS Multimedia Dev. Kit
MS Programmers Library
MS Sound System
MS Word For Windows
MS Works For Windows
Multimedia Textbook
Oxford Textbook of Medicine
Pro Audio Spectrum 16
Pro 16 Multimedia System
Soundblaster
Soundblaster 16
Sidekick Pro
Thunderboard
World Atlas (S. Trackerball)

COMMUNICATIONS

Carbon Copy Plus
Close-up Dual Pak
Co-Session (2-user)
Composeware Membership Kit
Logilink Pro 4.0
PC Anywhere 4.5
PC Anywhere 4.5 LAN
Procomm Plus
Prodigy Start-Up Kit

COMPETITIVE UPGRADES

Adobe Illustrator Up
Alpha 4 Up
Aldi Pro Up
Approach for Windows Up
Corel Draw Up
Clarion Professional Up
Pedoro Up
Dataviewer Windows Up
Freelance Graphics DOS Up
Freelance Graphics Windows Up
Lotus 1-2-3 Windows Up
Lotus SmartSuite Up
Lotus Symphony Up
MS Excel Up
MS Powerpoint Up
MS Visualbasic Windows Up
MS Word for Windows Up
MYOB Accounting Up
Norton Backup DOS Up
Paradox Up
Q & A Up
Timeline for Windows Up
Quattro Pro DOS Up
Quattro Pro Windows Up
Wordperfect DOS Trade-Up
Wordperfect Windows Trade-Up
Wordperfect Works Trade-Up

DATABASE

Alpha IV 2.0
C-Tree
CA-dBase 4 Compiler
CA-Realizer/Visual Tools II
Clarion Personal
Clarion Professional
Datastar 4.5
dBase III Plus 1.1
dBase IV 1.5
DBXL 1.3R
FoxPro (Microsoft)
FoxPro Distribution Kit
FoxPro LAN (6-Pak)
Paradox 4.0
Paradox SE
PC File 8.5
Professional File
Q & A 4.0
R & R Code Generator
R & R Reportwriter 4.0

DESKTOP PUBLISHING

All Type
Express Publisher
FFS: Publisher
Publish-It
Thee Type For DOS
Ventura Gold For DOS

GRAPHICS / PAINT / MICE

Autodesk Graphic Inspect #7 / #8
Automap / Bodyworks
Calendar Creator Plus
Certificate Maker
Deluxe Paint II Enhanced
Dr. Halo IV
Easy Flow
Flowcharting III
Formflier
Formtool Gold
Harvard Graphics 3.0
Instant Artist
Kensington Expert-serial
Kraft Trackball
Lotus Freelance Graphics
Logitech Mouseman-Ser.
MS Mouse
MS Mouse w/Paintbrush
MS Mouse w/Windows
Multimedia Explorer (Autodesk)
PC Paintbrush 5 Plus
Pizzaz Plus
Printshop Deluxe
Scanman 256
SIGNSC Advanced Stats
SPSS/PC Base
SPSS/Tables or Stats
Trackman

NETWORKING

Lantastic Ethernet Starter
Lantastic Ethernet Ad.
Lantastic For Windows Starter
Lantastic Starter Kit - 2 MB
Main LAN Easy Starter
Main LAN Ethernet Starter
MS Workgroup
MS Windows Wkgp. User Kit
MS Windows Wkgp. Add-On
MS Windows Wkgp. Upgrade
Novell Netware 2.2-5 u.
Novell Netware 3.11-5 u.
Novell Netware 3.11-20 u.
Novell Netware Lite / DR DOS 6.0

PROJECT MANAGEMENT

Harvard Project Mgr.
Org Plus Advanced
Project Scheduler V
Superproject 2.1 DOS
Timeline 3.0

PROGRAMMING

Brief Editor (Borland)
Btrieve For DOS
K-Edit 6.0
MS Basic PDS 7.1
MS C Compiler 6.0
MS Cobol Compiler 4.5
MS Fortran 5.1
MS Macro Assembler 6.0
MS Quick C 2.5
MS Quick C w/Assembler
MS Quick Pascal
MS Quickbasic 4.5
MS Visualbasic-DOS - Standard
MS Visualbasic-DOS - Prof.
Personal REXX
Powerbasic 2.1
RM Cobol 85
SPF / PC
Turbo C + + 3rd Ed.
Turbo Debugger & Tools
Turbo Pascal 7.0

SPREADSHEETS/INTEGRATED

CA-Supercalc 5.0
First Choice
Geoworks Pro
Lotus 1-2-3 2.4
Lotus 1-2-3 2.4 Lite Upgrade
Lotus 1-2-3 3.4
Lotus 1-2-3 For Home
Lotus Works
MS Multiplan
MS Works 3.0
Quattro Pro 4.0
Quattro Pro SE
WordPerfect Works

UTILITIES

3d Ad
3dfx Plus 6.0
Aditl
Anti Diag 4.0
Automenu
Battery Watch Pro
Central Point Anti-Virus
Central Point Backup
Check-It Plus
Copy II Dot Option Board
Copy II PC
Dan Bricklins Demo II
Desqview 2.4
Desqview 386 2.4
Direct Access 5.1
Disk Manager For DOS
Disk Optimizer
DOSFan Pro
DR DOS 6.0 / Netware Lite 1.1
Fast Fonts-DOS
FASTI
Fastback Plus
Fastpak Mail
Fastrez
Flight Simulator
Go-Script 4.0
Hi-Jack
Inforetrieval 2.0
Instant Recall
Label-Pro Laser or Dot
Labels Unlimited
Le Menu Plus
Lotus Agenda
Mavis Beacon Typing
MS DOS 5.0 Upgrade
MS DOS 5.0 w/Diskette
MS Learning DOS
Norton Anti-Virus
Norton Backup
Norton Commander
Norton Desktop DOS
Norton Utilities 6.01
Optune
PC Tools 6.0 w/AntiVirus
PC Tools 6.0 w/Backup
PCKwick/Powerpak/PowerDisk
Powerdomino Plus
Print-O
Printcache
Prokey
QA Plus
QDOS III
QEMM 386 6.0
Side City
Software Bridge 5.1
Spinrite II
Stacker
Super PC Kwik
Superdor 2.0
Superdor Pro
Typing Tutor V Plus
Ultrascript PC Plus
Wilmaster 4.0
Wonder Plus 3.5
Word For Word Pro
Xtree Gold 2.5

WORDPROCESSING

Grammatik V
Lexiperfect
MS Word 5.5
Multimate 4.0
Professional Write 2.2
Rightwriter 5.0
Screen Extender For WP
WordPerfect 5.1
WordPerfect 5.1 Stations
WordPerfect Office 3.1
WordPerfect Office (Su)
Xywrite III +
Zyindex For DOS

WINDOWS

ACCOUNTING & DATABASE

Access to Platinum-Win.
Amortizer Plus Windows
Approach For Windows
CA-Accpac Simply Acctg. Windows
dBfast For Windows
FoxPro For Windows
M.Y.O.B. Accounting
MS Access
MS Money For Windows
Paradox For Windows
Peachtree Acctg. Windows
Quicken For Windows
Superbase 4 Windows
Turbo Tax Windows

DESKTOP PUBLISHING

Adobe Illustrator 4.0
Express Publisher For Windows
Framemaker Windows
MS Publisher
MS True Type Font Pak
Omnipage Prof. 2.1
Pagemaker 4.0
Ventura Gold 4.0 Windows
Wordsoon Plus 1.1

GRAPHICS / PAINT

ABC Flowcharter / Windows
Autosketch For Windows
CA-Cricket Graph
CA-Cricket Image
CA-Cricket Presents
CA-Cricket Paint
Calendar Maker
Corel Draw 3.0 + CD
Drafix CAD For Windows
Freehand For Windows
Harvard Graphics Windows
Lotus Freelance Gr.-Win.
Method For Windows 3.0
MS Powerpoint
MS Project Windows 3.0
Org Plus Adv. Windows
Perform Pro Plus
Photofinish
Presentation Task Force
RBPS-Base Windows
Superproject Windows
Timeline For Windows
Windows Draw

PROGRAMMING

Borland C++ + 3.1
Borland C++ / Framework
Borland Pascal w/Objects
Btrieve For Windows
CA-Realizer For Windows
MS C + + Windows 7.0
MS Quick C Windows
MS Test For Windows
MS Visual Basic
MS Windows Developer Kit
Objectvision
Objectvision Pro
Smalltalk V Windows
Turbo C + + Windows
Turbo Pascal For Windows

SPREADSHEETS/INTEGRATED

CA-Cricket
CA-Simply Business
Lotus 1-2-3 Windows 1.1
Lotus SmartSuite
MS Excel 4.0
MS Office Windows
MS Works For Windows
Quattro Pro For Windows

UTILITIES

Acti For Windows
Adobe Type Align
Adobe Type Manager
Adobe Type Mgr. Plus Pak
After Dark For Windows
Automap Windows
Batch-it For Windows
BWFax Windows
C/P Anti-Virus For Windows
Carbon Copy Plus / Win.
Crossmath For Windows
Direct Access Windows
Fastlift For Windows
Fast Fonts-Windows
Fastback Plus Windows
Fontmonger
Hi-Jack Windows
Microphone II
More Fonts 3.0
MS Productivity Pak
MS Windows 3.1
MS Windows 3.1 Upgrade
MS Windows 3.1 / DOS 6 Upgr.
Norton Backup Windows
Norton Desktop Windows
Outside In / Windows
Pastrez 4.0
Printcept Plus For Windows
QA Plus For Windows
Typing Tutor V Windows
Wintex Pro
Wmsauth Gold
Wmsnd For Sound
Wmsnd For Sound Pro
Xtree For Windows

WORDPROCESSING

Acti Pro
Fonts-On-The-Fly
Grammatik For Windows
MS Word For Windows
Pro Write Plus
Textor (Computer Assoc.)
WordPerfect For Windows
Zyindex For Windows

XENIX/UNIX

Designer / X
Lotus 1-2-3 Unix (5-User)
Lotus 1-2-3 Unix-Server
SCO Professional +
SCO Unix 386 Development
SCO Operating - 2 user
SCO Unix Operating System
SCO VP / IX 3 + Users
SCO Xenix 386 OE
WordPerfect Unix (1u)
WordPerfect Unix (5u)
WordPerfect Xenix (1u)
WordPerfect Xenix (5u)

STACKER 3.0 # 82

The industry standard for data compression now supports DOS and Windows users. More than double the capacity of your hard disk and have improved speed with the Stacker optimizer. You can also Stack a floppy disk or any other removable media.

GENERIC CADD 6.0 #286

The best selling low cost 2D software in the world with over 300,000 units sold worldwide. This CADD package is loaded with features such as a hands on tutorial, hundreds of drawing & editing options, as well as Autocad compatibility. Professionals such as engineers, AEC professionals, drafting personnel, technical illustrators, tool designers, and map makers will find this software powerful yet easy to use.

$5 CLIP 'N' SAVE $5
FREE MONEY
Send in this coupon with any prepaid check and receive an additional $5.00 off your order.
$5 $5

VISA

SOFTWARE ADD-ONS

TWO GREENWOOD SQUARE SUITE 155 • BENSALEM, PA 19020

ORDER / INQUIRY LINE **1.800.695.8088**

FAX ORDER / INQUIRY LINE: **1.800.695.8087**

International Callers
Tele: 215-639-7110
Fax: 215-639-7234

*No surcharges on credit cards. *All returns are subject to Software Add-Ons 150-day limited warranty. Products returned must be unopened i.e. disks sealed and in re-saleable condition for warranty to apply. *All resaleable returns are subject to 10% restocking fee. *Prices, terms subject to change without notice.

CIRCLE 373 ON READER SERVICE CARD

The Best Peripherals...The Best Prices

Input Devices & Accessories

Logitech Fotoman Digital Camera	$499
Logitech Mouseman Serial/Bus	$69
Microsoft Mouse	$89
101 Click Keyboard	$39
101 Membrane Keyboard	$29
HC423 IDE/FDD Controller	$10
HC428 IDE/FDD/2 Serial/1 Parallel/1 Game (includes cables)	$17

GENIUS

Mouse w/Windows 3.1	$[illegible]
Hipoint - Notebook Trackball	$46
Color Hand Scanner w/LED	$292
HiPen - Pen Based Keyboard w/Software	$177
GT-12128 - 12" x 12" Genitizer w/Software & Templates (Input Devices & Accessories)	$222
Wireless Mouse	$[illegible]

PANAMAX

MAX4 - 4 AC Receptacles	$34
MAX6 - 6 AC Receptacles	$37
Telemax4 - 4 AC Receptacles, in/Out Phone	$49
Supermax - 4 AC Receptacles, in/Out Phone, RJ11/RJ45 included • TOP OF THE LINE • Lifetime Warranty • System Guaranty	$[illegible]

Math Co-Processors

INTEL

387-20/25/33	$85
387-SX 16/20	$79

ULSI SYSTEMS

Mathco 387-SX 16/20/25	$55
Mathco 387-DX 20/25/33	$63
Mathco 387-DX 40	$79

Call for special bundle deals on ULSI Math Co-Processors

1560

15" Medium Short Persistence Non-glare Flat Square Tube (FST) 0.28mm dot pitch 1024(H) x 768(V) non-interlaced

$429

Networking Products

ANSEL COMMUNICATIONS

A2500 Starter Kit with Novell Lite 1.1	$342
A2000 NE1000/2000 Ethernet	$105
A2600 Ad One User Kit	$174
A2700 Add One Portable Kit	$229
A2100 16 Bit Ethernet AUI & Coax	$77
A1500 16 Bit Ethernet 10 Base T	$77

ARTISOFT

Lantastic Starter Kit AE2/AE3	$448/$529
Lantastic LAN Cards AE2/AE3	$198/$229

3COM

Etherlink II/Five Pack (3C503)	$159/$709
Etherlink II 1 Base T/Five Pack (3C503TP)	$169/$719
Etherlink II 16 Bit BNC	$139
Etherlink 16 Bit (3C507)	$279

CNET

CN650E - 16 Bit NE2000 3-IN-1	$102
CN680E - 16 Bit NE 2000 10 Base T	$119
CN950E - 32 Bit 3-IN-1	$282

NOVELL

Novell Lite	$69
Ethernet NE1000/NE2000	$129/$155
Netware V2.2-5 User	$489
Netware V2.2-10 User	$1079
Netware V2.2-50 User	$2147
Netware V3.11-5 User	$587
Netware V3.11-10 User	$1341
Netware V4.0	$CALL

Call for products not listed above. We carry the full range of NOVELL products and software.

Hard Drives

CONNER

40MB	28ms	$145
80MB	19ms	$199
120MB	19ms	$242
170MB	19ms	$275
200MB	15ms	$355
510MB	12ms	$899

Maxtor

80MB	17ms	$219
120MB	15ms	$245
200MB	15ms	$372
340MB	13ms	$629

Seagate

40MB	28ms	$139
120MB	16ms	$265

ALPS

105MB	13ms	$229
210MB	13ms	$353

All Drives are IDE 3.5

CD-ROM

CD Revolution Multimedia Kit

Laser CM-205 Internal 375ms • No Caddy • Sound Blaster Pro Stereo Sound • LabTec self-amplified stereo speakers • Headphones • 6 Titles! $456

PROCOM

PC[illegible] Internal 375ms • No Caddy • Drivers Only	$275
PC[illegible] Internal 375ms, No Caddy, 4 Titles	$[illegible]
PC[illegible] Internal 350ms, No Caddy, 4 Titles	$419
SX[illegible] Internal IDE 380ms, 4 Titles	$519
SX[illegible] Internal SCSI 380ms, 4 Titles	$619

Computer Cases

AMPB - Baby AT Case w/300W PS	$62
AMPM - Mini Tower AT Case w/200W PS	$65
AMPM - Mini Tower AT Case w/ 200W PS and LED Display	$68
AMPL - Large Tower Case w/230W PS	$125

Tape & Floppy Drives

CHINON AMERICA, INC.

1.44 3.5" Floppy & frame/ 1.2 5.25" Floppy	$49/$52

COLORADO MEMORY SYSTEMS

Colorado Jumbo 120	$138
Colorado Jumbo 250	$197
Tracker 250	$433

Accessories and interfaces in stock, please call

TEAC CORP. OF AMERICA

1.44 3.5" Floppy w/frame	$53
1.2 5.25" Floppy	$55
Floppy 1.2 & 1.44 HH Combo NEW	$125

SONY

1.44 3.5" Floppy	$45

Printers

HEWLETT-PACKARD

Deskjet 500/500C/550C	$408/$549/$749
LaserJet IV w/Toner	$1488
LaserJet IIP + w/Toner	$808
LaserJet IIP w/Toner	$1027

COMPUTER PERIPHERALS

1MB upgrade kit for HP Series II	$79
2MB upgrade kit for HP Series II	$118
4MB upgrade kit for HP Series II	$185

PANASONIC

218C	$175
1123/1123i	$199/$275
1624/1654	$399/$519
1695/2624	$369/$399
4410/4430	$649/$899
4450/4455	$1079/$1719

Chips

256 x 4 chips	$5
256K 1Mb Simms	$11/$34
4MB Simms 70 nano	$CALL

Chip prices tend to fluctuate. Please call for current market prices on all SIMM and CPU's.

Videocards

ATI

VGA WONDER XL 1MB	$139
Graphics Ultra 1 MA	$319
8514 Ultra Plus 1 MB	$285
MVP8000 Local Bus VGA Micronics	$349

BOCA RESEARCH

Super VGA 1 MB	$109

COMPUTER PERIPHERALS

Viva MaestroPro Multimedia Stereo Sound Card w/Speakers	$139

DIAMOND

Stealth 24 - NEW!	$158
Stealth Pro - NEW	$242

SAMTEK

VC122 16 Bit VGA 256K	$24
VC126 16 Bit VGA 1 MB	$55

STB

PowerGraph X-24 1280 x 1024 1 MB	$CALL
STBVGA1 16 Bit 800 x 600 256K	$CALL
Evolution VGA 16 Bit 1024 x 768 1 MB	$CALL
Horizon 1280 x 1024 1 MB 16.7 VL Bus	$CALL

Modems

COMPUTER PERIPHERALS

2400 Internal/External	$29/$58
Viva 2496 Pocket (class 2 9600 FAX)	$95
Viva 2442it Internal (class 2 9600 FAX)	$105
Viva 2442et External Tower Design (class 2 9600 FAX)	$118
14.4 Internal with FAX	$209
14.4 External with FAX	$259

Add $15 for Windows Software for all Computer Peripherals Fax Modems

NUVOTEL

2400 Internal V.42 Bis MNP5	$29
2400 Pocket with 9600 FAX	$99
9600 FAX Card 24/7 Internal	$45

PRACTICAL PERIPHERALS

2400 Internal/External	$74/$98
9600 14.4 External w/FAX	$388

US ROBOTICS

14.4 External w/FAX	$518
14.4 Internal w/FAX Dual SM. w FAX	$725
14.4 Sportster w/FAX External/Internal	$315/$299
14.4 Sportster External/Internal	$262/$269
Worldport 2400 Pocket w/9600 FAX	$219
Sportster 9600 External w/FAX	$285

Motherboards

AMLI

V386 SX-25 AMI BIOS	999
V386 DX-33 w/64K Cache AMI BIOS	$168
V386 DX-40 w/64K Cache AMI BIOS	$188
V486 w/[illegible] Cache AMI BIOS	$[illegible]
V486 w/256K Cache AMI BIOS	$679

DEICO

Predator 5 14 Boards in One No CPU 64K Cache	$179
Predator I 14 Boards in One No CPU, 128K Cache, All Ports	$239
PREDDT - Predator I in Desktop Case FCC Class B Approved	$375

Call today for pricing on DEICO FCC Class B Approved complete systems

MICRONICS

33GCP 4DX8 486-33 ISA 256K Cache	$639
50GCP 4868 486-50 ISA 256K Cache	$1045
33ICP 486ii 486-33 EISA Local Bus 256K Cache	$968
50ICP 4868 486-50 EISA Local Bus 256K Cache	$1262
66ICP 4868 486-50 EISA Local Bus 256K Cache	$1365
486-33 Mini AT/A Local Bus w/256K Cache	$819
486 DX2 50MHz VESA Local Bus w/256K Cache	$943
486 DX2-66MHz VESA Local Bus w/256K Cache	$1179
33ICP3-NEW 486 DX33 Mini AT ISA w/256K Cache (no ports)	$619
50XCP-NEW 486 DX50 Mini AT ISA w/256K Cache (no ports)	$949
33ICPE3-NEW 486 DX33 Baby AT (no ports)	$839
50ICPE3-NEW 486 DX50 Baby AT (no ports)	$1029

Call for pricing on Micronics Local Bus VGA Adapters

MYLEX

486 SX-25 w/64K Cache	$375
486 DX-33 ISA w/256K Cache	$739
486 DX-50 ISA w/256K Cache	$979
486 DX-33 EISA w/256K Cache	$1344
486 DX-66 EISA w/256K Cache	1188
486-33 w/Local Bus VGA Built-in	$749
EISA SCSI Caching Controller	$486
EISA S3 VGA Adapter	$335
SPECIAL!! CPU 486 Cooling Fan	$39

Monitors

CTX

5[illegible] 14 1024 x 768 28	$269
5[illegible] 14 1024 x 768 28	$299
1560 15" 1024 x 768 NI FLAT	$429
1760DF 17" SVGA 1280 x 1024 26	$829
1760D 17" SVGA 1280 x 1024 31	$725

MAGNAVOX

CM9217 17" 1024 x 768 31 DCA	$865
20CM64 20" 1280 x 1024 31	$1299
78M749 14" White VGA	$112

WEN

1461 1024 x 768 28	$256
1461 1024 x 768 39	$218
1770 1280 x 1024 Flat Screen 17" 26	$799
2060 1280 x 1024 20" 31	$1150

FAX MACHINES

Canon NEW

FaxPhone 40 • 326 Roll • Multishades of Gray • G3	$288
FaxPhone 10 • NEW • FAX/TEL Switch Answer Machine Interface	$298
FaxPhone 80 • PLAIN PAPER • 164' Roll • Auto Paper Cut • Speed/Group Dial	$648
FaxPhone 870 • CUT SHEET PLAIN PAPER • BUBBLE-JET • UHQ 64 Shades • FAX/TEL Switch • Semi-Dual Access	$818

Po Box 2047, Norcross, Georgia 30091 Customer Service: (404) 246-9566
Technical Assistance: (404) 448-2708 FAX: (404) 449-1528
Hours EST 8:30 a.m. 7:30 p.m. Weekdays 11:30 a.m. 2:00 p.m. Saturdays

For Orders and Quotes
1-800-299-0200

No surcharge for credit cards.

We Export!

VISA MasterCard

AE12

TERM AND CONDITIONS

Prices and availability subject to change without notice. Purchase orders accepted from qualified customers. Shipping and handling 3½% (minimum $10 some items slightly higher) APO and FPO add 5%. COD orders add $8.00 service charge. Product warranties, offers and claims are handled by the manufacturers. DOA's repaired or replaced at our option during the first 30 days only. No returns on good items. All return shipments are subject to a 15% restocking fee. Defective software replaced with same item only. Call 404-448-2708 for a return authorization number prior to returning any product. Shipping charges not refundable. Peripheral Express cannot guarantee compatibility.

CIRCLE 324 ON READER SERVICE CARD

Peripheral Express

For Printers, It's Arlington!

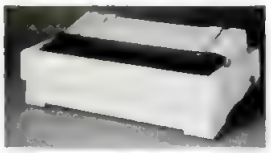
Arlington Computer Products is an authorized dealer for Canon, Okidata and Epson.

EPSON

LX810	$169	LQ1070	$349
FX870	$265	LQ1170	$569
FX1050	$349	LQ2550	$849
FX1170	$349	EPL8000	$1065
LQ570	$235	DFX5000	$1259
LQ870	$425	DFX8000	$2129

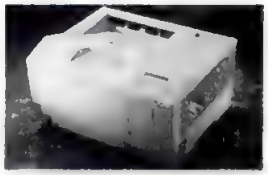
Action 1000 ..... $645
Action 1500 ..... $789
Action 3250 ..... $189

Scalable Fonts
Enhanced Graphics



■ LQ 1170

■ ACTION 1000
• 6 PPM
• 14 Fonts



■ EPL 8000 - 10 PPM

When you've got an Epson, you've got a lot of company.™

CHIPS

256K/1 MG Chips	each $3/$6
256K/1MB Simms	$15/$39
4MB Simms	$139
HP 2MG Upgrade	$99
Intel ISA 2 MB	$299
OKI Laser 2MB	$129

Intel

80287-10XL/XLT	$79
80387 SX-16/20/25	$75
80387-16/20/25/33	$85
Rapid Cad	$249
Overdrive SX20/25	$349/$435
Overdrive DX25/33	$435/$575

TEXAS INST.

TM 4000/WINSX 80	$2149
TM 4000/WINSX 120	$2349
LASER PS17	$1179
LASER PS35	$1279
LASER PS35 Turbo	$1489

SOFTWARE

Aldus Pagemaker	$489
Corel Draw	$369
Lotus 123 2.4/3.1	$329/$389
Microsoft Excel Wndws	$299
Microsoft Windows 3.1	$79
Microsoft DOS 5.0	$79
PC Tools 8.0	$119
Word Perfect 5.2	$259
Word Perfect Windows	$269

DRIVES & TAPES

Ext. 1.2 for PSII	$159
Toshiba 3½" 1.44	$69
Colorado Jumbo 120	$159
Colorado Jumbo 250	$219
Colorado Trakker 120	$339
Colorado Trakker 250	$399
Colorado QFA 700	$689
Irwin 120/250	$189/$249
Irwin Parallel 250	$419

AMERICAN UPS

250	$109	600	$259
400	$165	900	$375
450	$199	1200VX	$729

CD ROM OPTICAL DISKS

Media Fusion	$499
NEC CDR-74 Gallery	$629
NEC CD Express	$409
Sound Blaster Media	$559

SEAGATE HARD DISKS

40 MB for AT (ST251-1)	$239
80 MB for AT (4096)	$349
106 MG 3120A	$219
120 MG 3144A	$249
245 MG 3283	$389

IOMEGA

Tape 250 Insider	$249
90 MB Ext. w/boot card	$799

PLUS HARD CARD

40 MB/50 XL	$299/$229
127 MB/240 MB	$259/$529

CONNOR HARD DRIVES

40/120 MB	$199/$269
200/540 MB	$389/$919

HEWLETT-PACKARD

Laserjet IV w/Toner	$1399
Laserjet IIP+ w/Toner	$809
Laserjet IIIP w/Toner	$949
Laserjet IIID w/Toner	$2389
Laserjet III SI w/Toner	$3249
Paint Jet	$739
1MG Upgrade	$69
2MG Upgrade	$99
4MG Upgrade	$149
Deskjet 500/500C	$399/509
Deskjet 550C	$729
Pacific Page/XL	$269/$629
Pacific Data 25 in 1 Font	$239
PacData Deskjet 25 in 1	$99

NETWORKING

Netware 2.2 5 User	$489
Netware 2.2 10 User	$1079
Netware 2.2 50 User	$2099
Netware 3.11 5 User	$579
Netware 3.11 10 User	$1329
Netware 3.11 50 User	$2619
Lantastic 10BPS Starter	$449
E143 Ethernet	$189
Lantastic 2M bps Kit	$329
Lantastic 2M bps Adapt	$129
NE1000 Ethernet	$99
NE2000	$139
AST 5251-II Plus	$499
Ethercard +/+16	$119/$139
3 Com EtherLink II	$185
3 Com EtherCard	$279
Intel Ether 16	$119
Intel Ether 16-5 Pack	$499
Intel Ether 16-20 Pack	$1779
Intel Ether EISA 32	$575
Intel Token Express	$479
Irma Board 3	$399

SCAN. & DIGIT.

Epson 600C	$789
Epson 800C	$1089
Logitech ScanMan	$135
Logitech ScanMan 256	$259
Mustek Gray Artist	$159
Mustek Color Artist	$299
Summasketch 12×12	$269
Summasketch 12×18	$479

Panasonic Office Automation

1123	$195
1124I	$275
2123	$229
2124	$299
2180	$179
1624	$329
1654	$519
2624	$359
4410	$599
4430	$859
4450I	$1059
4451	$1379
4455	$1679
4410/4450I 2 MG	$129

OKIDATA

ML320	$299
ML321	$419
ML380	$219
ML590	$419
ML591	$569
ML393	$909
ML393C	$979
PM3410	$1229

OL400	$589
OL400 2MB	$129
OL810	$1029
OL820	$1219
OL830	$1259
OL840	$1559

NEC

P3200	$225
P3300	$325
P6200	$399
P6300	$599
P9300	$825
Model 95 Pscrpt Laser	$1379
Model 990 Pscrpt Laser	$1475

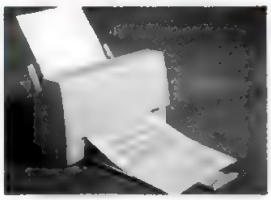
Arlington Computer Products, inc.

FOR ORDERS & QUOTES:

800-548-5105

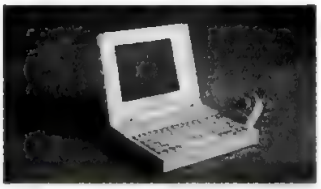
Canon

BJ-10EX $245
BJ-20EX $359
BJ-200 .....$325
BJ-300 .....$325
BJ-330 .....$555
BJC-800.....$1779
BJC-820.....$1929
LBP-4SX $889
LBP-8SX $1289



■ BJ-200 — 360 DPI

■ LBP-45 SX



■ CANON NOTEBOOK INNOVA
386 NX - 386 SL - 25 Mhz $1599.00

CANON INNOVA COMPUTERS
One Year On-Site Warranty!

■ 386-SX 33, 4 MB, 105 MG, .28 SVGA Monitor, 3.5 and 5.25 Drives, Dos 5.0, Windows 3.1, MS Works $1199.00

■ 486-SX 25, 4 MB, 130 MG, .28 SVGA Monitor, 3.5 and 5.25 Drives, Dos 5.0, Windows 3.1, MS Works $1499.00

Canon has "Bubble-Jet" Technology!

Ask about Canon's new line of Notebooks.

VIDEO BOARDS

ATI VGA Wonder 1MG ... $149
ATI VGA Stereo $199
ATI Graph Ultra 1MG $269
ATI Graph Ultra +..... $279
ATI Graph Prof $439
ATI Graph Prof 2 MG $499
Sound Blaster Prof..... $169
Boca Super VGA $99
Diamond Stealth 24 ..... $229
1024 VGA 16 Bit $79
Orchid Pro IIS 1MG..... $159
Orchid Farenheit 1MG ... $249
Paradise VGA 1024 ..... $139

MONITORS

NEC

3 FGX..... $609
4 FG $709
5 FG $1245
6 FG $2249
Multisync VD $1549

MITSUBISHI

EGA $239
Diamond Scan 4533C $429
Diamond Pro 17 ..... $1069
6605 16" $939
HL6955 20"..... $1779

PANASONIC

1381 VGA 1024×768..... $319
1395 VGA 1024×768..... $429
1991 VGA 1280×1024.... $1539

SAMSUNG

14" Sync Master 2 ..... $249
15" Sync Master 15 ..... $479
17" Sync Master 4 ..... $769

MODEMS

PRACTICAL PERIPHERALS

Practical Per. 2400 Int. $69
Practical Per. 9600 Int. ... $199
Practical Per. 9600 Ext.... $229
Practical Per. 14.4 Int..... $309
Practical Per. 14.4 Ext. ... $279
Practical Per. FaxMe $169

Hayes

Hayes Accura 96/Fax $259
Hayes Accura 14.4/Fax... $309
Hayes Optima 96 ..... $329
Hayes Optima 14.4/Fax .. $439
Hayes Ultra 96..... $549
Hayes Ultra 96 14.4 ..... $589

US Robotics

16.8 HST Ext..... $489
14.4 Dual Std. 16.8..... $709
Sportster 14.4 Int..... $269
Sportster 14.4 Ext. $299
Sportster 14.4 Int. Fax.... $289
Sportster 14.4 Ext. Fax ... $279

intel

SatisFAXtion MODEMS

100 2400/9600 Fax $99
200 2400 V.42/9600 Fax .. $269
300 14.4/9600 Fax..... $275
400 14.4/14.4 Fax $369
400 Ext 14.4/14.4 Fax $375
Faxability Plus $59
Faxability Plus/OCR $159

CIRCLE 336 ON READER SERVICE CARD

ARLINGTON COMPUTER PRODUCTS... GREAT SERVICE SINCE 1984!

- PC Magazine "...Arlington offers worry-free mail order purchasing!"
- PC Sources Product Review "...You can be confident that what you order will work!"
- PC Computing Phantom Shopper "...Courteous service and terrific technical support!"

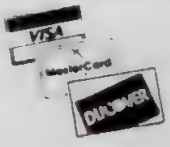
Prices and availability subject to change without notice. Purchase orders accepted from Qualified Customers.

CIRCLE 336 ON READER SERVICE CARD

Hours C.S.T.
7:30-6:30 pm-Mon-Fri
9:00-1:00 pm-Saturday

1970 Carboy.
Mt. Prospect, IL 60056

NO SURCHARGE FOR CHARGE CARDS!



CUSTOMER SERVICE AND IN ILLINOIS
708-228-6333
SHIPPING
708-228-9748
TECHNICAL ASSISTANCE
708-228-1470
FAX
708-228-0516

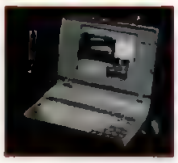
Arlington Computer Products, inc.

FOR ORDERS & QUOTES:

800-548-5105

COMPUTER DISCOUNT WAREHOUSE

TOSHIBA T4400C Color 486SX/25



✓ 120 or 200 MB ✓ Color TFT-LCD Active Matrix ✓ 256 Simultaneous "Super VGA" Colors at 640 x 480 Resolution ✓ 4 MB RAM Exp. to 20 MB ✓8KB Cache in CPU ✓Upgradeable to i486DX/25 ✓Port for External VGA Monitor ✓ Real Time Clock/Calendar ✓ Full-Function Standard 82-Key Keyboard ✓ MS-DOS® 5.0 ✓ One Year Limited Warranty on Parts and Labor with No-Cost Exceptional Care Enrollment During This Time

120 MB ..... $3319.13 CDW 25488

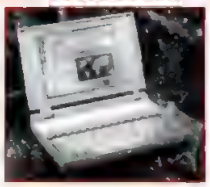
200 MB ..... $3999.40 CDW 25542

WHY PAY RETAIL?

CDW® Sells For Less

AND **SERVICES** YOU BETTER

TOSHIBA T3300SL 386SL 25MHz



✓ Intel 386™ SL CPU, 25 MHz ✓ 2 MB Standard, Expandable to 18 MB ✓ 120 MB HD 16 msec. Access Time, 1.44 MB, 3.5" Floppy ✓ VGA Compatible Display ✓ Fluorescent, Sidelit LCD with 32 Gray Scale ✓ 640 x 480 Resolution ✓Full Function, Stnd., Key Spaced, 82-Key Keyboard ✓ Clip for Microsoft® BallPoint™ Mouse ✓ VGA Monitor Port ✓ 9-Pin Serial Port ✓ 150-Pin Connector ✓ MS-DOS® 5.0 ✓ 5.9 lbs with Battery Pack ✓ Comes with 1 Yr Parts/Labor, with No-Cost Exceptional Care

3300SL 120MB..... $2079.52 22182

TOSHIBA PERFORMANCE, TOSHIBA QUALITY, TOSHIBA VALUE!

TOSHIBA T4500/T4500C

3.3 VOLT NOTEBOOKS

✓ i486SX/20 Processor ✓ MaxTime™ Power Management System and 3.3 Volt Technology for Extended Battery Life ✓ 4MB RAM, Expandable to 20 MB ✓ 8MB Cache ✓ 640 x 480 Display ✓ Simultaneous Display on External Monitor ✓ BallPoint® Mouse with QuickPort™ 16 mm "Hot Plug" PCMCIA Slot ✓ Windows 3.1, DOS 5.0 and UltraFont Software ✓ 1 Parallel, 1 Serial, 1 PS/2 Mouse and 1 PS/2 Keyboard Ports ✓ One 150-Pin Bus Connector ✓ Monochrome: 9.5" Diagonal, 64 Gray Scales. Color: 8.5" Diagonal TFT-LCD Active Matrix 256 Color Display

80 MB Monochrome..... $2327.28 CDW 25545

120 MB Monochrome..... $2489.19 CDW 25546

120 MB 256 Active Matrix Color .... $3659.27 CDW 25551

TOSHIBA T1800

SUPERIOR ENGINEERING

✓ 20 MHz i386®SX Processor ✓ 2 MB RAM Expandable to 10 MB ✓ Bright 9.5" VGA Display with 64 Gray Scales ✓ 1.44" MB 3.5" Diskette Drive ✓ 4+ Hours Battery Life ✓ Math Co-Processor Socket ✓ Full Function 82-Key Keyboard ✓ Built-In Interface for 101-Key Keyboard (Requires Adapter) ✓ Dedicated Modem Slot for Toshiba or Third Party Modems ✓ One Parallel, One Serial, One PS/2 Mouse Port ✓ Pre-Loaded DOS 5.0 ✓ Flash ROM ✓ One Year International Warranty ✓ Weighs only 6.8 lbs.

60 MB T1800 ..... $1087.91 CDW 24286

80 MBT1850, 25 MHz, 4 MB RAM ..... $1422.56 CDW 24662

120 MBT1850, 25 MHz, 4 MB RAM ..... $1629.31 CDW 25644

80 MB T1850 Color, 25 MHz, 4 MB..... $2111.88 CDW 24663

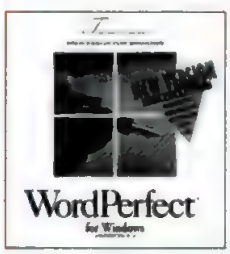
120 MB T1850 Color, 25 MHz, 4 MB $2296.20 CDW 25643

WordPerfect® WordPerfect 5.1 for DOS

The World's Best-Selling Word Processor

✓ The New Tables Feature Lets You Easily Create Organized Rows and Columns of Tabular Data That Are Automatically Enclosed In Graphic Lines ✓ WordPerfect Ships with a Macro That Creates Mailing Labels ✓ The Equation Editor Includes a Comprehensive Collection of Symbols, Characters, and Mathematical Operators and Functions ✓ The Pull-Down Menus Can Be Accessed By a Single Keystroke ✓ You Can Set Left, Right, Center, and Decimal Stops. Settings Can Be Viewed On Your Screen

3.5" ..... $257.45 CDW 14597



WordPerfect 5.2 for Windows The Best Word Processor for Windows

✓ New Means Better with WordPerfect 5.2 for Windows. And New Also Means More Functional Than Ever Because WordPerfect Gives You the Power Tools You Need to Make Work Quick and Easy! ✓ QuickFinder: This Exciting New Feature Offers Fast and Efficient Indexing and Text Retrieval Functionality. With QuickFinder You Can Build Indexes for Groups of Files Which Dramatically Speeds Up Searches. You Decide Which Files to Index, and You Can Create As Many Files As You Need ✓ OLE Support: Now You Can Use Elements From Any Windows 3.1 OLE (Object Linking & Embedding) Server Application with Your WordPerfect Documents. Just By Double Clicking On the Linked Object within Your Document, You Can Launch the Application Used to Create the Object. ✓ Grammar Checker: WordPerfect Now Ships with Grammatik 5. ✓ New Button Bars: What Could Be Easier Than Button Bars for Tasks Such as Merge, Macros, Graphics, Format, and Generate. ✓ Adobe Type Manager Fonts: Adobe Type Manager (ATM) is Now Included Along with a Collection of Type 1 Fonts. ✓ Mail-Enabled: You Can Send a Document On Your Screen *Immediately* Via E-Mail. Just Click On the Name of Your Mail Package From the File Menu–You Never Have to Leave WordPerfect.

3.5" ..... $248.75 CDW 26207

AT CDW® YOU GET MORE COMPUTING FOR YOUR BUCK. CALL NOW!

◗ CDW® means Service ◗ CDW® means Savings ◗ CDW® means Business ◗ CDW® means Experience ◗ CDW® means Technology ◗ CDW® means Networking ◗ CDW® means Computing PCM633

FREE TECHNICAL SUPPORT FOR CDW® CUSTOMERS (708) 291-7575

(800) 326-4CDW

WE SELL NAME BRANDS FOR LESS!

©1993 CDW® Computer Centers, Inc

ALWAYS WORKING TO KEEP YOUR COMPUTING ONE STEP AHEAD.

COMPUTER DISCOUNT WAREHOUSE

1 OF THE NATION'S LARGEST OKIDATA DEALERS

WHY SETTLE FOR LESS?

CDW® Sells For Less

AND **SERVICES** YOU BETTER

"May I recommend CDW® for extra-ordinary service to a customer." — B. K. Mooselake, MN

"CDW® has left me with a good impression. I will not hesitate to order from you again." — J.P. Peabody, MA

Your #1 Source for OKIDATA Printers & Accessories!

OL810 NEW Lower Price!

The Value-Packed Printer For Growing Businesses

✓ LED Page Printer ✓ 8 PPM ✓ 300 DPI, OKI Smoothing Technology™ ✓ 1 MB RAM Standard ✓ 5 MB RAM Maximum ✓ HP LaserJet® III, IBM® Proprinter® III XL, OKIDATA OL400 Compatibility ✓ 200 Sheet Paper Tray ✓ 13 Resident Scalable Fonts, 42 Bitmap Fonts ✓ PostScript Upgradable ✓ Industry's Best Warranty: 5 Years. on Printhead, 1 Year Parts/Labor on Printer

CDW Price

CALL CDW 23104

OKIDATA®

OL400

The Personal LED Page Printer for Smaller Budgets

✓ 4 PPM ✓ 300 DPI ✓ More Standard Typefaces & Fonts than HP® LaserJet® IIP ✓ High-Capacity 200-Sheet Paper Tray Included ✓ Slim Low-Profile Design Fits Any Desktop ✓ HP® Series II Compatible ✓ Industry's Best Warranty: 5 Years. on Printhead, 1 Year Parts/Labor on Printer

CDW Price

$569.00 CDW 12884

EXCEPTIONAL VALUES!

OL830 Plus NEW

The Revolutionary PostScript LED Page Printer Is an Outstanding Value

✓ 2 MB RAM ✓ 17 PostScript Fonts ✓ 8 PPM with Adobe PostScript and ATM 2.0 Standard ✓ 300 DPI, OKI Smoothing Technology™ ✓ Adobe PostScript and PCL Emulations ✓ DOS/Windows Drivers ✓ Second Paper Tray, Serial and Apple Talk Interfaces Optional ✓ Industry's Best Warranty: 5 Years on Printhead, 1 Year Parts/ Labor on Printer

CDW Price **CALL** CDW 27207

OL850 NEW

The Postscript LED Page Printer forYourEnvironment

✓ 8 PPM ✓ 300 DPI Resolution ✓ 26 Bitmapped and 35 Adobe Scaling Fonts ✓ OKI Smoothing Technology™ ✓ 200-Sheet Paper Tray: 2nd Tray Available ✓ AppleTalk Interface ✓ ATM for both Windows and Macintosh ✓ Drivers for DOS, Windows, and Macintosh Software ✓ Industry's Best Warranty: 5 Years on Printhead, 1 Year Parts and Labor on Printer

CDW Price **CALL** CDW 27208

EXCEPTIONAL OKIDATA ACCESSORIES

Toner Cartridge 400/800 Series	$18.89 CDW 16117	Second Paper Mechanism for 830	$238.61 CDW 20883
Drum 400/800 Series	$209.55 CDW 16813	TMS Roman Font 400/800 Series	$138.82 CDW 17897
Serial I/O Card 400/800 Series	$68.75 CDW 17840	Courier Font 400/800 Senes	$138.82 CDW 18177
200 Sheet Letter Tray 400/800 Series	$64.88 CDW 13498	Prestige Font 400/800 Series	$138.82 CDW 18154
200 Sheet Legal Tray 400/800 Series	$64.88 CDW 12971	Tax Font 400/800 Series	$138.82 CDW 18095
15 Envelope Tray 400/800 Series	$64.88 CDW 14956	Letter Gothic Font 400/800 Series	$138.82 CDW 19920
Memory Expansion Boards	CALL	Postscript Essentials Font for 830	$268.23 CDW 21528

MOST ORDERS RECEIVED BY 7:30 P.M. C.S.T. SHIP SAME DAY

IF YOU FIND A BETTER PRICE CALL US BEFORE YOU BUY
2840 MARIA, NORTHBROOK, IL 60062 FAX (708) 291-1737

PC Magazine says..."You may find a better deal here than anywhere else."

WHY WAIT? CALL COMPUTER DISCOUNT WAREHOUSE™ NOW! PCM633

WE SELL NAME BRAND ITEMS FOR LESS!

CDW® EXTENDED HOURS
Sales: 7:30-7:30 CST Mon-Fri.
(708) 291-7575

CDW

(800) 326-4CDW

In Illinois (708) 564-4900

FAX (708) 291-1737

Credit card charges are not submitted until time of shipment.

1993 CDW Computer Centers, Inc.

COMPUTER DISCOUNT WAREHOUSE - SERVICING YOUR PC NEEDS SINCE 1982 - DON'T ACCEPT ANY IMITATIONS

No Surcharge on Credit Cards

High Volume Bids Invited

COMPUTER DISCOUNT WAREHOUSE

NEW **Hayes Accura 144 + FAX144**

✓ Cost Effective V.32bis/14,400 bps Data and Group 3/14,400 bps FAX Modem ✓ V.42/ V 42bis, MNP 5, + 9600-300 bps Data ✓ Free Smartcom Data and FAX Software and Modem Cable ✓ Synchronous ✓ 2 Year Warranty

CDW® Price.....$325.58 CDW 27349

WHY SETTLE FOR LESS?

CDW® SERVICING YOUR COMPUTER NEEDS SINCE 1982

AST PowerExec™ EL Color Notebook

Combines the Highest Level of Computer Technology and Intelligence to Provide You with the Ultimate Notebook Computer.

✓ Powerful 25 MHz, Intel386™ SL Processor ✓ 64 KB of Cache Memory and 4 MB of Standard RAM ✓ 3.5", 1.44 MB Diskette Drive ✓ Passive Matrix Color ✓ 256 Colors at 640 x 480, VGA Resolution ✓ 9.5" Diagonal Viewing Area ✓ 82/83-Key Keyboard, 12 Function Keys ✓ MS-DOS from AST™

CDW® Price CALL

AST, "AST" logo, and AST Premium registered and Cubid-32 and Exec trademarks AST Research Inc. All other product and brand names are trademarks or registered trademarks of their respective companies.

HARDWARE, SOFTWARE & PERIPHERALS AT DISCOUNT PRICES

NETWORKING PRODUCTS

NOVELL

NOVELL Netware V2.2, 5 User 3.5"	469.50
NOVELL Netware V2.2 10 User 3.5"	999.73
NOVELL Netware V2.2, 50 User 3.5"	2084.78
NOVELL Netware V2.2, 100 User 3.5"	2975.57
NOVELL Netware V3.11, 5 User 3.5"	552.17
NOVELL Netware V3.11, 10 User 3.5"	1252.17
NOVELL Netware V3.11, 20 User 3.5"	1752.17
NOVELL Netware V3.11, 50 User 3.5"	2502.17
NOVELL Netware V3.11, 100 User 3.5"	3499.96
NOVELL Lite Wrvlor DOS	69.00
NOVELL Lite Starter Kits	399.77
NOVELL Lite Add-On Kit	199.65
ETHERNET Interface Connector (NE1000)	129.44
ETHERNET Board (NE2000)	136.06
ETHERNET Eisa (NE3200)	687.50

ARTISOFT

AE1/T 10 Base T Adapter, 8-Bit ARS-190	129.52
AE2/T Ethernet ISA Adapter,16-Bit ARS-170	179.58
AE3 Ethernet Adaptor	219.26
NOS AI Software	54.50
E143 Ethernet Adapter Kit	184.79
LANtastic Ethernet Starter Kit 4.0	448.31
LANtastic Ethernet Starter Kit for Windows	499.10
LANtastic 2Mbps Starter Kit	325.50
LANtastic 10 Base T Starter Kit	599.20
LANtastic 2Mbps Adapter	129.54
LANtastic for Windows	149.17

CALL FOR ADDITIONAL ARTISOFT PRODUCTS

SMC® ACCESSORIES

SMC 3512 TP 12 Node Concentrator	619.18
Active Hub 8 Port Coax	229.88
Active Hub 8 Port Twisted Pair	345.00

SMC INTERFACE CARDS

3008 Coax 8-Bit Ethernet	89.82
3008 TP 10 BaseT 8-Bit Ethernet	105.53
3016 TP 10 BaseT 16-Bit Ethernet	134.50
PC 600FS Coax Arcnet File Server 16 Bit	199.00
PC 650WS TP Arcnet Workstation 16 Bit	119.88
PC 650FS TP Arcnet File Server 16 Bit	199.25
PC 600WS Coax Arcnet Workstation 16-Bit	119.88
SMC PC130 8-Bit Arcnet Coax	68.50
SMC PC130E 8-Bit Arcnet Coax	99.00
SMC PC270 TP Arcnet	109.33
Eisa 3200 Arcnet Twisted Pair	736.08
SMC 8-Bit 10 Base T Ethernet Elite	119.48
SMC Ethernet Plus/A PS/2 Coax Elite	219.10
SMC 16-Bit Ethernet Plus Coax Elite	129.50
SMC 8-Bit Ethernet Plus Coax Elite	105.29
SMC Combo Ethernet TP Coax, AUI Elite	164.57

3Com®

3COM 3C503 TP 10 Base T	229.88
3COM 3C507 Ethernet Card	279.61
3COM 3C503 Etherlink	188.24
3COM 3C509 TP Etherlink III	137.25
3COM Ethernet Repeater	829.03

THOMAS-CONRAD

6242 Arcnet 8-Bit	86.20
6245 Arcnet 16-Bit	179.31
6245 Twisted Pair Plus Ethernet	215.07
6246 PS/2 Board Arcnet	214.16
6151-11 16 Port Smart Hub	709.01
4045 16/4 Token Ring XT/AT	458.23

XIRCOM

Arcnet Pocket Adaptor Coax	239.50
Arcnet Pocket Adaptor RJ45	234.77
Ethernet Pocket Adaptor Thin Coax	299.55
Ethernet Pocket Adaptor 10 Base T	329.55
Parallel Port Multi	72.00
PT2168T Token Ring Pocket Adaptor	530.23

TAPE, REMOVABLE & FLOPPY DRIVES

i-MEGA

21 MB Floptical Insider Diskette Drive	339.00
21 MB Floptical Ext Diskette Drive	379.10
Tape 250, 250MB Tape Back up	223.10
Bernoulli PC Powered 90/Pro	469.25/ 589.57
Bernoulli Transportable 90 Pro	639.81
Bernoulli Transportable 150 Pro	869.25
Bernoulli Insider 90 Pro	549.47

COLORADO

COLORADO Jumbo 120	157.37
COLORADO Jumbo 250	219.32*
COLORADO QFA700	719.15
COLORADO Tracker 120MB Portable Back-up	365.00
COLORADO Tracker 250MB Portable Back-up	419.21

Call For Accessories And Interfaces

SUMMIT

SUMMIT 120MB Int	144.39
SUMMIT 250MB Int	199.34
SUMMIT 305MB Internal IDE 10MB/min	249.90

MICROSOLUTIONS

External 100MB HD	499.06
Backpack External Floppy 3.5"	199.41
Backpack External Floppy 5.25"	199.41
External 80-250MB Tape Backup	379.30

Mountain

MOUNTAIN TD250 Internal Tape Backup	229.90
MOUNTAIN 120MB External Tape Drive	449.90
MOUNTAIN 250MB Internal Backup	474.42
MOUNTAIN 304MB Internal IDE Backup	439.50
MOUNTAIN 250MB External Backup	1179.22
MOUNTAIN 2.0 Gigabyte External Filesafe	1976.40
MOUNTAIN 4.0 Gigabyte 4mm DAT	2399.23

Call For PS/2 Drives, Controllers, Accessory Kits and Tapes

IRWIN

IRWIN A120PC-120 MB Internal	219.19
IRWIN A250PC-250 MB Internal	296.89
IRWIN A120E-120 MB High Speed External	299.13
IRWIN A250E 250 MB High Speed External	346.68

Call For Controllers, Accessory Kits and Tapes.

NETWORKING PRODUCTS

IBM TOKEN RING

IBM 16/4 PS/2 MCA	999.11
IBM 16/4 XT/AT	499.27
IBM 16/4 Multi Access Unit MAU	432.26

INTEL NETWORKING

INTEL Token Express EISA 16/4	626.88
INTEL Ether Express 16-Bit Coax	123.53
INTEL Ether Express 16-Bit TP	122.33
INTEL Token Express XT/AT 16/A	399.23
INTEL Ether Express EISA 32-Bit	367.30

BORLAND dBase IV LAN Pak	626.37
BORLAND Quattro Pro Network Node	244.30
DC Mail Products	CALL
HARVARD GRAPHICS LAN Pack	CALL
LOTUS 1-2-3 2 4 Server	558.86
LOTUS 1-2-3 2 4 Network Node	339.47
LOTUS 1-2-3 3 4 Server	CALL
LOTUS 1 2 3 3 4 Network Node	CALL
MICROSOFT Word 5 5 Network Node	185.39
MICROSOFT Excel Network Nodes	249.11
WORD PERFECT Office 5-User V 3 01	278.79
WORD PERFECT Office 20PK V 3 01	923.08

TERMINALS

WYSE 50 Amber or Green	349.15
WYSE 60 Amber or Green	279.92
WYSE 160/30 Amber or Green	327.86/274.89
WYSE 185 VT320 Amber, Green or White	327.60
WYSE 150 Amber, Green or White	265.45
WYSE 325 Color/ 325ES Low Emission	389.40/549.39

**After Manufacturer's $150 End-User Rebate

MULTIMEDIA, SOUND, CD's, FAX

ARTISOFT, Wired for Sound	39.49
ATI Stereo FX Sound Card	109.76
BRODERBUND Carmen San Diego Deluxe CD	39.10
COMPLETE PC Communicator Data, Fax, V Mail	139.56**
CD-ROM Software 5 CD's Bundle, Call For Titles	109.18
CDWEL SYSTEMS Artshow	179.25
CDWEL SYSTEMS Desk CD	419.29
CREATIVE LABS Sound Blaster	95.93
CREATIVE LABS Sound Blaster PRO BASIC	149.18
CREATIVE LABS Sound Blaster Professional	179.29
CREATIVE LABS MultiMedia Starter Kit	449.82
CREATIVE LABS MultiMedia Int Upgrade Kit	549.82
INTELLICOM Long Link	117.76
JETFAX II SendRec Plain Paper Faxes on your Laser	519.32
KEYTRONICS 101+ Keyboard	93.50
MICROSOFT Beethoven's 9th For Windows CD	49.50
MICROSOFT Bookshelf For Windows	119.20
MICROSOFT Multimedia Dev Kit Windows	309.40
MICROSOFT Programmer's Library	249.75
MICROSOFT Works For Windows CD	119.20
ORCHID Sound Producer	149.43
SONY Desktop Libraries Int & Ext	CALL

CD-ROM & OPTICAL DRIVES

HITACHI 3600	409.30
HITACHI 1700S External	467.42
MAGNAVOX 461RS Ext w/CD Bundle	338.00
MAGNAVOX Int MPC CD ROM	329.00
NEC CDR 25 Express Bundle	409.23
NEC CDR 37 External Portable	379.40
NEC CDR 74 External	584.36
NEC CDR 74 Multi-Media Bundle	819.32
NEC CDR 84 Internal	519.87
PANASONIC LF5010 Worm External	2199.91
PANASONIC LF7010 Ext. 1 Gb Erasable Optical	2599.20
SONY CDU-7205N External CD-ROM	483.10
SONY CDU-535 Internal CD-ROM	279.10
SONY CDU-54101 Internal SCSI CD-ROM	418.32
SONY SMO-S501 650MB Erasable Optical	2595.42
TEXEL CD ROM Int 265 ms/ Ext 265 ms	395.43/469.27
TOSHIBA 3301 External	509.64

PLOTTERS, DIGITIZERS & SCANNERS

HURTA

KURTA 12 x 12 XLP/12 x 18 XLP	199.50/ 499.29
KURTA 12 x 17	539.27

CalComp

CALCOMP 12 x 12 w/16 But	279.92
CALCOMP 12 x 18 w/16 But	559.77
CALCOMP 2024/2036 Pacesetter	2779.00/ 3599.00
CALCOMP Classic 4036	4747.25
CALCOMP Design Mate 3024	1919.27

Summagraphics

Summagraphics Summa III 12 x 12	253.60
Summagraphics Summa III 12 x 18	319.60
EPSON ES600C Color SCSI Scanner	837.99
EPSON ES800C Color SCSI Scanner	1088.40

HOUSTON INSTRUMENT

HOUSTON INSTRUMENTS DMP-61	2075.00
HOUSTON INSTRUMENTS DMP-161	2619.49
HOUSTON INSTRUMENTS DMP 162	3389.51

HEWLETT PACKARD

HP7575 DXL/HP7576A EXL	3098.88/ 3967.25
HP7475A/HP7550B	1300.25/2999.70
HP DESIGNJET 600 A-D	5879.35
HP DESIGNJET 600 A-E	6949.30
HP SCANJET IIP/HP7570A	849.10/2529.30
HP SCANJET II C Color XT/AT	1439.10

No Surcharge For Credit Cards... Means LOWER Net Cost To You!

SOFTWARE

ACT Software 2.1	222.50
ADAPTEC CD Software Driver	59.67
AUTODESK Autosketch	85.30
AUTOMAP Road Atlas	49.98
BANNER BLUE Org. Plus Advanced	59.30
BORLAND TURBO C++ V3.0	85.58
BORLAND C++ App Framework	469.98
BORLAND dBase IV 1.5	399.23
BORLAND ObjectVision Pro 2.1	317.70
BORLAND Paradox V 4.0	419.70
BORLAND Paradox V 4.0 Node	325.40
BORLAND Quattro Comp Upgrade	89.78
BORLAND Quattro Pro 4.0 DOS	93.88
BORLAND Sidekick V 2.0	54.67
BORLAND Turbo C++	68.58
BORLAND Turbo Pascal	99.30
CA Clipper V5.0.2	469.91
CA Simply Business	389.48
CA Up To Date	98.55
CENTRAL POINT PC Tools V 8.0	119.88
CLARION Professional Developer	433.33
DAC Easy Accounting 4.2	85.33
DELRINA DOS Fax Pro	49.91
FIFTH GENERATION Fastback Express DOS	52.86
FIFTH GENERATION Fastback Plus 3.1	89.14
FIFTH GENERATION Direct Access	63.77
GENERIC CADD 6.0	249.10
INTUIT Quicken 6.0	39.93
INTEL LAN Fax	199.67
INTEL LAN Spool 286/386	257.10 /369.21
LASERTOOL & Fonteuine	59.88
LOTUS 1-2-3 V2.4	319.95
LOTUS 1-2-3 V 3.4	395.50
LOTUS Agenda V2.0	125.91
LOTUS Freelance Graphics	298.78
LOTUS Improv	CALL
LOTUS Magellan	65.95
LOTUS Organizer	CALL
LOTUS Symphony	465.50
LOTUS Upgrades	93.81
MICROCOM Carbon Copy V6.0	109.37
MICROSOFT C Compiler 6.0	298.80
MICROSOFT C Compiler 7.0 Upgrade	134.50
MICROSOFT DOS 5.0 Upgrade	59.98
MICROSOFT Flight Simulator 4.0	39.93
MICROSOFT Fortran Compiler 5.0	274.44
MICROSOFT Foxpro 2.0	479.18
MICROSOFT Fox Pro 2.0.6 User	539.36
MICROSOFT PowerPoint Upgrade	98.77
MICROSOFT Quick Basic Compiler 4.5	64.78
MICROSOFT Sound System	CALL
MICROSOFT Visual Basic	119.20
MICROSOFT Word V5.5	199.80
MICROSOFT Works	89.92
POWER UP! Calendar Creator Plus	41.80
PROCOMM Plus	65.50
QUARTERDECK Deasqview 386 V.2.4	119.88
QUARTERDECK QEMM 386 Manager	59.90
QUARTERDECK QRam & Manifest	49.30
QUARTERDECK Deasqview	72.10
QUALITAS 386 Max 5.0	59.98
REFERENCE Grammatik	59.25
SOFTWARE PUB. PFS: Write	154.30
SOFTWARE PUB. Harvard Graphics V3.0	367.88
STACKER SOFTWARE	89.98
STACKER Software And Board For AT 16 Bit	179.98
SYMANTEC NORTON Advanced Utilities V6.0	97.43
SYMANTEC NORTON Commander	93.24
SYMANTEC PC Anywhere Remote	82.11
SYMANTEC PC Anywhere Node	22.50
SYMANTEC Q &A 4.0	239.08
SYMANTEC Q &A Lan Pack 4.0	299.01
TRAVELING SOFTWARE Laplink Pro	95.58
WORDPERFECT 5.1 5.25" or 3.5"	256.95
WORDPERFECT LetterPerfect	84.11
WORDPERFECT 5.1 Node w/o Manual	188.57
XTREE Gold V2.5	89.98

AT CDW® YOU GET MORE COMPUTING FOR YOUR BUCK. CALL NOW!

CDW® means Service ♦ CDW® means Savings ♦ CDW® means Business ♦ CDW® means Experience ♦ CDW® means Technology ♦ CDW® means Networking ♦ CDW® means Computing PCM633

FREE TECHNICAL SUPPORT FOR CDW® CUSTOMERS (708) 291-7575

(800) 326-4CDW

WE SELL NAME BRANDS FOR LESS!

ALWAYS WORKING TO KEEP YOUR COMPUTING ONE STEP AHEAD

©1993 CDW® Computer Centers, Inc

COMPUTER DISCOUNT WAREHOUSE™

NEC SilentwriterII 95F

PostScript® Power and PCL Level 5 Emulations

✓6 PPM ✓68000 Operating at 16.7 MHz ✓300 x 300 DPI Resolution ✓2 MB RAM Std., Exp. to 5 MB ✓Accepts Model 9510 Fax Bit ✓Adobe® PostScript Level II ✓35 Scalable Adobe Fonts, 14 Bitmap and 8 Scalable HP LaserJet Fonts ✓250-Sheet Letter Cassette, Built-In 15-Envelope Feeder ✓Hook Up a Macintosh and a PC Simultaneously with Automatic Interface Monitoring ✓Standard Auto Emulation Software

CDW® Price.....**$1119.33**** CDW 26470

** After Manufacturer's $250 End-User Rebate

WHY PAY RETAIL?

CDW® Sells For Less

AND **SERVICES** YOU BETTER

HARDWARE, SOFTWARE & PERIPHERALS AT DISCOUNT PRICES

COMPUTERS

AST

AST POWEREXEC EL 3/25 60HD	1299.00
AST POWEREXEC EL 3/25 120HD	1995.00
AST POWEREXEC EL 3/25 Color	CALL
AST POWEREXEC 3/25SL 4MB, 160HD, Color	3043.92
AST POWEREXEC 3/25SL 4MB, 120HD	2260.43
AST POWEREXEC 3/25SL 4MB, 60HD	1826.59
AST POWEREXEC 486/25SL Mono	1826.00
AST POWEREXEC 4/25SL 4MB, 200HD, Color	3217.33
AST Power Premium 486DX 4/66c, EISA, 4 MB, VGA, 1 Flop	2438.52
AST Power Premium 486DX 4/50d, EISA, 4 MB, VGA 1 Flop	2130.43
AST Power Premium 486DX 4/33 EISA, 4 MB, VGA, 1 Flop.	1978.26
AST Power Premium 386DX 3/33 EISA, 4 MB, VGA, 1 Flop.	1882.94
AST Premium Tower ERA SE 4/33 8MB 1 Floppy	3042.39
AST Bravo 4/33, 2MB, 1 Floppy VGA, DOS	1159.22
AST Bravo 4/50d, 2MB, 1 Floppy, VGA, DOS	1587.85
AST Bravo 4/66d, 2MB, 1 Floppy VGA, DOS	1849.04

Canon

INNOVA 386SX/33 Desktop 2 MB 85HD	829.55
INNOVA 386SX/33 Desktop 4 MB 105HD	997.96
INNOVA 486SX/25 Desktop 4 MB 130HD	1309.23
INNOVA 386SL/25 Notebook 4 MB 60HD	1675.00

DTK Grafika

386/33 DX, No HD 4MB VGA, 2 Flop [illegible]	932.96 / 1137.50
486/33 DX, Tower No HD 8MB, VGA, 2 Flop [illegible]	1410.23 / 1728.41
486/33 DX No HD 8MB VGA, 2 Flop [illegible]	1330.68 / 1807.95
486/50 DX, Tower, 200HD 8MB, 2 Flop, DOS, Win	1851.14
486/66 DX2, Tower, 200HD 8MB, 2 Flop, DOS, Win	2348.59

NEC

PowerMate 425 120 HD 4 MB SVGA	1188.74
PowerMate 433 120 HD 4 MB SVGA	1559.64
NEC Ready 486SX/25, 4 MB, 170 MB, 2 Floppies	1314.82
NEC Ready 486DX/33, 4 MB, 170 MB, 2 Floppies	1659.29
ULTRALITE SL/20 80 MB Notebook	1509.13
ULTRALITE SL/20 120 MB Notebook	1529.91
ULTRALITE SL/25/C Color 80 MB Notebook	2280.28
ULTRALITE SL/25/C Color 120 MB Notebook	2498.30

Texas Instruments

TM WIN SLC/25 486 60HD 2MB	1719.86
TM WIN SLC/25 486 80HD 4MB	CALL
TM 4000 WIN DX25 120HD 4MB VGA	2837.74
TM 4000 WIN DX25 200HD 4MB VGA	3089.15
TI TM4000 WinSX25 120HD, 4 MB VGA,	2388.48

TOSHIBA

4400C 25MHz 4MB 200HD	3319.00 / 3999.00
4400SX 25MHz 2MB 120HD	LCD 2228.66 / CRT 2499.03
6400D1 33MHz 4MB 200HD GP	3796.38 / 5697.89
T1800SX-20 2MB 60HD	1087.91
T3400SX-25 4MB 80HD	LCD 1422.56 / CRT 2111.68
T4[illegible] 4MB [illegible]	LCD 1629.44 / CRT 2286.15
T4500 486SX-25 4MB 80HD 120HD	LCD 2327.62 / CRT 2489.98
T4500C Color 4MB 120HD	3659.32

KINGSTON MEMORY

1MB 4MB AST Cupid Simms	59.93 / 156.00
AST Exec 386SX 4 MB Module	155.17
[illegible]	118.18 / 201.23
1MB/2MB Upgrade HP LaserJet IIP / IIP 4Q/	119.72
1MB OKI Laser 400	75.50
2MB IBM 70/50Z	96.20
[illegible]	96.60

KINGSTON FOR COMPAQ

2MB/4MB Memory Board CPQ LTE 286	129.20/ 197.27
2MB/4MB Memory Board CPQ Lite	179.12 / 208.47
4MB Module CPQ - 386, 20E/25E	214.46
PROLINEA, PROSIGNIA, DESKPRO,	CALL
CONTURA, SYSTEM PRO XL	CALL

KINGSTON FOR TOSHIBA

4MB 2200SX	179.51	2MB 2200SX	119.79
8MB 4400SX	445.30	8MB 6400SX	529.30
4MB 4400SX	249.03	4MB 6400	289.03
2MB 3300SL	119.00	4MB 3300SL	179.00

ACCELERATOR/OVERDRIVE

INTEL Overdrive 486/25DX 486/33DX	479.56/639.55
INTEL Overdrive 486/SX 25MHz 20 MHz	473.20/355.44
INTEL Overdrive 486/33SX	[illegible]
KINGSTON SX Now 25 MHz IBM 50 60 50Z	216.20
KINGSTON 486SX Now 25 MHz Compaq	399.72
KINGSTON 486DX Now 33 MHz Compaq	729.89

DOT MATRIX & LASER PRINTERS

EPSON

LX810	165.03	LQ570	234.40
FX870	259.74	LQ870	436.00
FX1170	345.25	LQ2550	559.27
LQ1070	345.20	DFX 5000	1278.00
DFX 5000	1278.00	DFX8000	2147.00
AP2250	115.30	AP3250	188.13
Action Laser 1000 6PPM PCL4			CALL
Action Laser 1500 6PPM PCL5			CALL
EPL 8000 Laser 10 Pages Per Minute			1077.13

NEC

Silentwriter II 95F	1119.33**	P6300	599.50
Silentwriter II 97			1699.29
P6200 24-pin	399.92	P3200 24-pin	219.88
P3300 24-pin	522.58	P6300	869.21

Canon

CANON BJ10EX/BJ20 Bubble Jet			248.40/ 319.68
CANON BJ200 Bubble Jet			324.12
CANON BJ300 Bubble Jet			332.20
CANON BJ330 Bubble Jet			568.84
CANON LBP4SX Laser 4PPM			889.14
CANON LBP8SX Laser 8PPM			1309.03

OKIDATA

[illegible]	[illegible]	ML591	419.20
OL400	569.00	[illegible]	569.52
[illegible]	[illegible]	ML380	209.00
OL830	999.96	ML393+	919.20
[illegible]	[illegible]	[illegible]	959.50
[illegible]	[illegible]	ML321	417.08

Panasonic

1124 I	264.25	1624	339.93
1123	199.47	1180 I	157.00
4430 Laser	858.95	2624	369.46
2180	180.92	2123	239.09
1654	539.89	4450 Laser	1099.12
4410 Laser Printer	818.95	4455 Laser PS	1749.78

Texas Instruments

TI Microlaser PS17 /PS35	1163.00/ 1261.26
TI Microlaser TurboPlus PS	1479.55

Hewlett Packard

CPI JETMEMORY 1MB for HPIIP/III/IIID	75.90
CPI JETPAGE for HP IIP/IID/III Postscript	184.40
Co-Star Labelwriter II Win/DOS Software	CALL
Dataproducts 960 RISC PS 9PPM	1419.95
Dataproducts 965 RISC PS 9PPM	2269.15
H-P Deskjet 500/H-P Laserjet IIP Plus	388.50/ 799.00
H-P Deskjet 550C/Deskjet Portable	699.12/ 995.11
H-P Laser III Si	3229.78
H-P Paintjet/Paintjet 300XL	708.00/ 2259.18
H-P Deskjet 500 Color	517.39
H-P LaserJet IIIP	949.10
H-P LaserJet 4	1399.46
KODAK Diconix 701/ Parallel	209.40/ 292.22
KODAK 180 Si Parallel/180 Si Serial	279.28 / 292.22
PACIFIC DATA 25 in 1 Cart LAS3	245.00
PACIFIC DATA Page Postscript 4 HP LAS3	279.64
PACIFIC DATA 1 MB for 2P II/IID/IIIP	79.45
SEIKOSmart Label Printer / Pro	CALL / CALL

DRIVES, TAPES & CARDS

PLUS Hardcard IIXL 105MB			269.70
PLUS Hardcard IIXL 50 MB			219.70
MAXTOR 130 MB	IDE		249.78
MAXTOR 213 MB	IDE		339.03
MAXTOR 340 MB	IDE	13MS SCSI	594.55
[illegible]	[illegible]	[illegible]	959.92

Seagate

ST1239A	469.94	SEAGATE ST 2511	228.41
ST3120A,106MB	233.94	ST4766F 766MB	1076.80
ST4120N 1050MB	1379.71	ST351/AX	149.82
ST3144A 130MB IDE	16MS		275.51
ST1239A 211 MB IDE			349.94
ST1480A 426 MB IDE			849.37
ST1624A 668 MB SCSI			1213.64

MICROPOLIS

1684-7 345MB HH			909.44
1684-7 340 MB			1033.86
[illegible]	[illegible]	[illegible]	1249.30
[illegible]	[illegible]	[illegible]	1719.42

CONNER

CONNER 40 MB	120 MB		149.34/ 265.17
[illegible]	[illegible]	[illegible]	197.76/ 424.63
CONNER 174MB/510MB			277.58/949.56
CONNER 543MB SCSI			959.27

MODEMS & COMMUNICATIONS

U.S. Robotics

16.8 & 14.4 Courier Dual Std Ext	709.65
16.8 & 14.4 Courier Dual Std Ext Fax	719.44
14.4 Sportster External	281.30
14.4 Courier V.32 bis Ext	409.05
14.4 Sportster w/Fax External	319.98
16.8 HST Courier Ext Fax	579.10
9600 Sportster w/Fax External	274.44
9600 V.32 Worldport External	285.58
9696 V.32 Worldport External w/Fax	329.73

Hayes

ACCURA 144 + FAX144	325.58
ACCURA 96 + FAX96	279.30
ACCURA 2400B, +400	75.10/180.25
ULTRA 144 V.32 External	618.36
OPTIMA 14.4 + Fax14.4	419.56/ 444.49
ULTRA 9600 External	559.98
OPTIMA 9600 V.32/+Fax96	339.50/369.20
OPTIMA 2400 +Fax96	117.34/142.34
Pocket Edition	99.92

Practical Peripherals

14.4 V.32 BIS Snd/Rcv FAX External	399.22
14.4 V.32 BIS Snd/Rcv FAX Internal	339.52
14.4 Snd/Rcv Fax Mini Tower	279.44
14.4 Snd/Rcv Fax Pocket	338.99
9600 V.32 Ext. 269.10 9600 V.32 Int	259.23
9600 Snd/Rcv Fax Mini Tower	229.21
2400 V.42 Int 109.10 2400 V.42 BIS Ext	119.55
2400 Ext. Fax Modem 92.50 Pocket 2400	98.00
2400 Internal Fax Modem	89.50
Fax Me Rcv Fax cartridge for HP Lasers	179.57

Intel

SatisFAXtion 100 Int 2400 Data 9600/4800 Fax	98.90
SatisFAXtion 200 Int 2400 v.42 Data 9600 Fax	284.10
SatisFAXtion 300 Int 14.4 Data 9600 Fax	284.09
SatisFAXtion 400 Int 14.4 Data 14.4 Fax	379.04
SatisFAXtion 400E ext 14.4 Data 9600 Fax	429.50

MULTI-TECH

MULTI-TECH MT932BA 9600	462.62
MULTI-TECH 14.4 Ext Fax/ Modem V.32 BIS	478.11
MULTI-TECH MTE14EA	429.10

MATH COPROCESSORS

INTEL 387DX 16/20/25/33			78.99
INTEL 387SX 16/20/25 / 387SX 33			74.95/ 88.68
INTEL 287XL/287XLT			78.00/ 78.00
INTEL 487SX/387SL Mobile			349.44/ 75.88
INTEL Rapid CAD For All 386 DX's			229.10
[illegible]	[illegible]	[illegible]	67.75
[illegible]	[illegible]	[illegible]	75.40
[illegible]	[illegible]	[illegible]	79.50

BATTERY BACKUP AND UPS

AMERICAN

Smart1250	729.87	BACK UPS 900	379.88
Smart 400	307.96	Smart 600	399.10
BACK UPS 250	98.25	Smart 900	549.55
BACK UPS 400/450/600			158.25/188.68/259.84
Smart 2000			1134.80

[illegible]

BC-250	99.30	BC-400	155.10
BC 500	179.55	BC 500 LAN	189.77
BC-600 LAN	248.13	BC-900 LAN	348.51
BC-1250 LAN	479.27	OMNI 450 LAN	289.17
OMN 600 LAN	348.69	OMN 900 LAN	495.50
LapPower DC/AC 125W			59.50

MICE

APPOINT Thumbelina Trackball	89.27
LOGITECH Fotoman	489.30
LOGITECH Mouseman Ser. or Bus/w/Win3	98.83/105.30
LOGITECH Mouseman Cordless	79.33
LOGITECH ScanMan 32/Scanman 256	129.55/258.25
LOGITECH SerialTrackmanII/Portable	74.99/95.50
MICROSOFT Mouse Bus or Serial/No Sftw	95.50/79.80
MICROSOFT Mouse w/Windows 3.1	144.95
MICROSOFT Ball Point Mouse	108.50
MICROSOFT Serial, No Software	79.80
ZNIX Super Mouse II w/Windows 3.1	75.75

WINDOWS SOFTWARE

ACT ... Software for Windows	229.40
ALDUS PageMaker	462.58
ARTISOFT Lantastic for Windows	147.17
BERKLEY After Dark for Windows	29.20
BORLAND Turbo C++ for Windows	99.39
BORLAND Object Vision 2.0	84.08
CAERE Omnipage Professional 2.0	580.43
CALERA Fax Grabber for Windows	55.48
CALERA Wordscan + for Windows	381.42
Carbon Copy for Windows	119.38
COREL SYSTEMS Corel Draw 3.0	349.99
CROSSTALK for Windows	119.85
DELRINA Win Fax Pro	69.95
INTUIT Quicken for Windows 2.0	39.67
LOTUS 123 For Windows	292.33
LOTUS AMI Professional for Windows 3.0	233.09
LOTUS Freelance Graphics	326.30
LOTUS SmartSuite for Windows	455.24
MICROGRAFX Designer 3.1 for Windows	355.42
MICROSOFT Access	94.80*
MICROSOFT Excel for Windows 4.0	289.25
MICROSOFT Foxpro 2.5 for Windows	CALL
MICROSOFT Office	439.89
MICROSOFT Project for Windows	409.10
MICROSOFT Publisher	115.20
MICROSOFT Windows 3.1	89.95
MICROSOFT Windows Upgrade 3.1	48.95
MICROSOFT Windows 3.1 Developers Kit	209.47
MICROSOFT Windows for wkgps starter	529.18
MICROSOFT Windows for wkgps Add on User	59.95
MICROSOFT Windows for wkgps 5 User	239.50
MICROSOFT Word for Windows	289.25
MICROSOFT Works for Windows	116.98
PROCOMM PLUS for Windows	85.91
SOFTWARE PUBLISHING Superbase 4 for Windows	439.33
SYMANTEC NORTON Desktop for Windows	107.61
SYMANTEC NORTON Backup for Windows	83.33
SYMANTEC PC Anywhere IV DOS/Win	99.95
WORDPERFECT For Windows 5.2	248.95
WORDPERFECT For Windows 5.2 Upgrade	74.95

VIDEO PRODUCTS

SAMSUNG 12" Amber Mono	568.95
SAMSUNG 14" White Mono VGA	115.86

VGA & SUPER VGA MONITORS

MAGNAVOX Super VGA 1024 x 768 .39mm	289.24
MAGNAVOX Super VGA .28mm 7CM9088	399.00
MAGNAVOX 7BM749 Mono 14" VGA	109.50
Magnavox 17" CM9217, .31mm	795.58
MAGNAVOX 20 CM654 .20 Inch	1299.00
NEC Multisync 3FGX/4FG	515.50 / 735.00
NEC Multisync 5FG/6FG	1247.93 /2296.57
NEC Multisync 2A/NEC Multisync 5D	389.30/1459.15
NANAO 17" 1280 x 1024 .28 mm FST	1109.39
PANASONIC C1381, 1024 x 768, 14"	325.76
PHILIPS 1436 14" 800 x 600 .28 "	389.86
PHILIPS 1557 15" 1024 x 768 .28	599.84
RELISYS 14" .28 1024 x 768 "	279.46
SAMSUNG CCB 7571, 17",1280x1024	875.50
SEIKO CM1760CR	999.15
SONY 1320 / 1304S	333.50 / 589.60
SONY 1604S, 17" / 1936, 20"	995.42 / 1978.50
Zenith 394M 14" .39, 1024 x 768,	239.50

VGA & SUPER VGA DISPLAY CARDS

[illegible]	[illegible] 5.16
ATI EISA GRAPHICS ULTRA Pro 2 MB	579.92
ATI GRAPHICS ULTRA +1 MB/2 MB	288.27/318.55
ATI GRAPHICS ULTRA Pro 1 MB 2 MB	426.97/496.62
ATI MCA GRAPHICS ULTRA Pro 2 MB	579.92
[illegible]	[illegible] 24.84
ATI INTEGRA	79.38
[illegible]	[illegible] 28.18
ATI VGA Wonder XL24 1 MB	143.23
ATI VGA Wonder Turbo	CALL
[illegible]	[illegible] 47.50
[illegible]	[illegible] 21.99
[illegible]	[illegible] 14.50
HERCULES Graphite 1 MB	274.29
ORCHID Prodesigner IIS 1 MB	145.45
ORCHID 24-Bit Farenheit 1280 1MB	195.83
ORCHID Farenheit VA 1MB 1280 x 1024	205.32
VIDEO 7 Win VGA 1MB	98.74
VIDEO 7 VGA 16	89.41

*While Quantities Last

MOST ORDERS RECEIVED BY 7:30 P.M. C.S.T. SHIP SAME DAY

IF YOU FIND A BETTER PRICE CALL US BEFORE YOU BUY 2840 MARIA, NORTHBROOK, IL 60062 FAX (708) 291-1737

CDW® Carries Over 8000 Computer Products At Discount Prices. If You Don't See It, Call!

WHY WAIT? CALL COMPUTER DISCOUNT WAREHOUSE™ NOW!

PCM633

WE SELL NAME BRAND ITEMS FOR LESS!

CDW® EXTENDED HOURS
Mon - Fri: 7:30 - 7:30 CST (Mon-Fri)
Sat: 9:00 - 5:00 CST (Sat)
Sun: Closed
Technical Support Questions
(708) 291-7270 8:00-7:30 CST (Mon-Fri)

Credit Card charges are not submitted until time of shipment. Freight is collect. Most in the continental U.S. will receive their shipment in 2 business days. Freight charges and handling additional. Non-defective returns subject to restocking fee. Allow 10 business days for shipping when paying by personal check. Software, chips and other electronic components are not returnable. All pricing subject to change. ™ - Trademarks of all companies listed in this ad.

CDW® BULLET OF SERVICE

(800) 326-4CDW

In Illinois (708) 564-4900

FAX (708) 291-1737

Credit card charges are not submitted until time of shipment

©1993 CDW® Computer Centers, Inc.

COMPUTER DISCOUNT WAREHOUSE™ - SERVING YOUR PC NEEDS SINCE 1982 - DON'T ACCEPT ANY IMITATIONS.

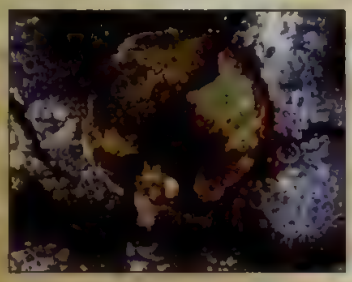
No Surcharge For Credit Cards

High Volume Bids Invited

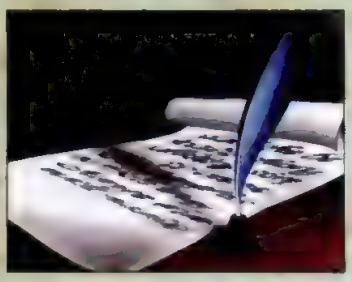
The Evolution of CAD

From the beginning of time, we have tried to express ourselves through graphics.

In the beginning of time people had to use primitive design tools for creating any type of graphics.



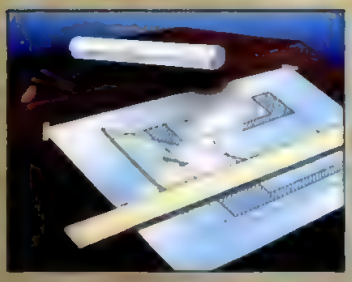
In the 15th Century design tools were quill ink pens and crude styles of paper.



300 to 400% less $ than AutoCAD!

Faster and easier to use than AutoCAD!

By the 18th Century we had advanced to the drafting table with T-squares, and the dreaded eraser.



In the 20th Century the first CAD programs were very slow and extremely difficult to use, not to mention the expense of buying them.

Now step into the 21st Century...

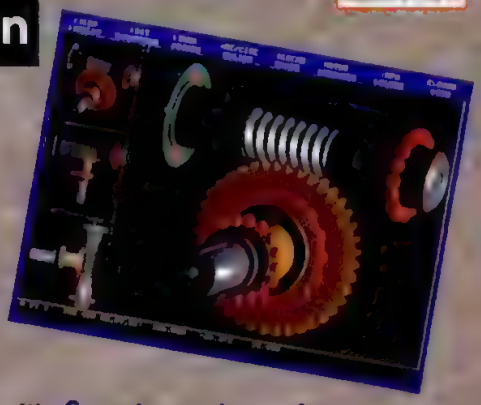
DesignCAD

NEW

Professional Version

PC MAGAZINE EDITORS' CHOICE

PC MAGAZINE EDITORS' CHOICE



DesignCAD Professional is the only complete CAD solution. It's 6 packages in one!

- **DesignCAD 2D** has all the tools and power necessary to produce professional architectural or mechanical blueprints. With DesignCAD 2D you will become extremely productive!
- **DesignCAD 3D** gives you the power to create and manipulate solid or wireframe objects with quick and easy commands. Render your designs with outstanding photorealistic color!
- **Video Training Tapes** for DesignCAD Professional, are produced in a state-of-the-art facility using award winning writers, and professional technicians. Using these video tapes will assure you of learning faster with higher retention, while becoming more productive!
- **SmartEST** quickly generates a spread sheet from your DesignCAD drawings so you may estimate cost, and do take-offs for accurate bidding.
- **Symbol Libraries** contain over 6700 pre-drawn Architectural and industry standard symbols. These alone will save you a tremendous amount of time and money!
- **ScanPRO** converts (Raster to Vector),scanned images into files that can be read by DesignCAD or most other CAD programs.

Call, fax or write for a FREE brochure & demo!

American Small Business Computers

One American Way
Boxor OK 74361

ph: (918) 825-4844 fax: (918) 825-6359

The direct line for all your DTP needs...and more. **800-327-8111**

Publishing Perfection

Photoshop for Windows

Adobe Systems Incorporated

Adobe Photoshop 2.5 software is the world's leading photo design and production tool. It lets you create exactly what you imagine, whether you work in the Macintosh or Windows environment. With Adobe Photoshop and your computer, you can design and produce color and black-and-white images right at your desk. Start with a blank screen or any scanned image. Then add or correct color, execute delicate retouching, import illustration files, create duotones, tritones and quadtones, and more. And when you've got just what you want, produce it – with professional controls for four-color-process proofing and separations.

$569

Adobe Illustrator

Illustrator 4.0 $399 (for Windows)

Competitive Upgrade $179

We also include Adobe Type Manager, Adobe Type Align, Adobe Streamline 3.0 (while supplies last), and Adobe Separator software, plus 40 Adobe Type 1 typefaces and a collection of predrawn artwork.

"★★★★★ Top Notch, a must buy." Publish June 1992

Illustration Applications

Adobe Illustrator	$399
Aldus Freehand	$379
Arts & Letters Graphics Editor	$399
Corel Draw	$359
Professional Draw	$259
Micrografx Designer	$369

TEXEL CD-ROM Drives

DM-3024 Internal **$428**,w/ interface **$498**, w/ Pro Audio Spectrum 16 & cable **$665**

DM-5024 External **$528**,w/ interface **$598**, w/ Pro Audio Spectrum 16 & cable **$795**

Multisound MPC Kit...Internal $1289
MMB2 Bundle ..... Internal $1088
..... External $1188
MMPRO Bundle ..... External $1398

LaserPix 5.0

2400 DPI for Graphics and 1200 DPI for Text on your HP LaserJet II, III or 4 **$1399**

ImageXpert 1000 (1200 DPI printer)	2599
ImageXpert 5000DLE (1200 DPI text)	5129
ImageXpert 5000 (1200 / 2400 DPI)	5799

TOSHIBA CD-ROM Drives

Toshiba 3401 Series CD-ROM Drives feature SCSI-2 interface, 200ms access, Double speed 150KB/sec. / 330KB/sec. transfer rate, 256KB buffer, Contamination-free sealed enclosure, Automatic lens cleaning mechanism, Audio playback capable, Multisession Photo CD compliant, CD-XA ready, MPC compliant, 4X oversampling for studio-quality Red Book Audio.

Toshiba 3401B Internal	$528
Toshiba 3401E External	$628
Toshiba 3401P Portable	$659

Interface Options: XT/AT – $129 Parallel to SCSI – $89 Mac – $79

Or get the Pro Audio Spectrum 16 and custom cables, with 3401B for $766, with 3401E for $896.

CD-ROM Software – (dozens of other CDs available, call!)

Classic Collection Plus: Multimedia Audubon's Birds, Multimedia Audubon's Mammals, The Complete Shakespeare, The Complete Sherlock Holmes **$79, $49** w/drive
Media Clips MPC-4 Disc Set: World View, Wild Places, Jets, Props **$69, $59** w/drive
Toolworks Bundle 1992: Toolworks Multimedia Encyclopedia 1992, Reference Library, World Atlas MPC, US Atlas MPC, Loom **$199, $149** w/drive
Toolworks MPC Bundle: Mavis Beacon Teaches Typing, Chessmaster 3000, Great Cities of the World, World Atlas, US Atlas **$199, $149** w/drive

	Price	w/drive
Accumail	169	155
Amanda Stories MPC	45	45
American Family Physicians 85-91	199	199
American Heritage Ency Dictionary	69	69
Amabel's Dream MPC	69	69
Audubon's Mammals Multi-Media	39	39
Bible Library	79	29
Birds of America	39	39
CD Game Pack II	59	49
CD-ROM Directory 1992	109	109
CD-ROM In Print 1992	99	99
Chessmaster MPC	59	29
CIA World Fact Book	39	29
Composer Quest	65	55
Compton's Family Choice	79	79
Compton's Multimedia Encyc.	499	199
Compton's Interactive Encyclopedia	259	259
Electronic Home Library	69	29
Electronic Library of Art	75	72
Family Doctor	59	49
Family Practice Library	579	579
Font Fun House PS fonts Win/Mac	45	39
Great Cities of the World MPC	35	35
Guinness Disc of Records	59	59
Guinness MPC Disc of Rec.	79	79
Information USA	99	99
Jones in the Fast Lane	42	42
Languages of the World	189	139
Library of the Future, 1st Edition	149	65
Library of the Future 2nd Edition	249	249
Macmillan Dictionary for Children	45	35
Mammals by National Geographic	89	49
Marketing Master 1992	99	49
Mavis Beacon Teaches Typing MPC	49	29
Media Clips Jets & Props	59	39
Media Clips Wild Places	38	31
Media Clips World View	31	31
Microsoft Bookshelf DOS	139	129
Microsoft Multimedia Beethoven	57	53
MS Cinemania	53	53
MS Encarta	249	249
MS Multimedia Bookshelf for Win.	139	139
Mixed Up Mother Goose MPC	42	42
Monarch Notes	79	79
North American Fax Book	79	99
Officer's Bookcase: Military Terms	79	79
Oxford Textbook of Medicine	579	559
PC-Game Room	59	49
Pediatrics on Disc	229	229
PhotoDisc Vol. 1, Bus. & Industry	297	285
Place-Name-Index	636	485
Plant Doctor	79	49
Playing With Language MPC	55	55
Presidents, It All Started w/George	109	109
ProPhone National directory (3 CDs)	179	179
Publish It! 2.01 with Clip Art	95	49
Reference Library-PC	97	35
Secret of Monkey Island	49	29
Secret Weapons of the Luftwaffe	49	29
Shakespeare on Disc	29	29
Shareware Bonanza (3 CDs)	89	79
Shareware Gold II - Windows	75	49
Sherlock Holmes on Disc	29	29
Sherlock Holmes, Consulting detect.	45	29
Sporting News Baseball G&R	79	79
Stats Baseball Library 1992	89	75
Street Atlas USA Windows	109	109
The Multi Bible Vol. 1	119	99
The Ultimate Shareware Collection	79	59
Time Almanac	109	29
Time Traveler Chronicle Hist.	139	129
Timetable of History	55	29
Toolworks Illustrated Encyclopedia	239	49
Total Baseball	59	58
Ultima I-VI	79	69
US Atlas MM	49	35
US & World Atlas	79	49
US Atlas w/ Automap Bundle	69	49
US History	189	35
US Presidents	49	49
Vital Signs MPC	79	79
Voyage to the Planets I, II, or III	89	59
Windows Shareware Gold	69	45
Wing Com. & Secret Missions 1 & 2	65	29
Wing Commander & Ultima VI	49	29
World Atlas MPC	59	49

Hewlett Packard Lasers & Scanners

	w/ 2MB Upgrade	w/ Pac Page & 4MB	w/ Pac Page XL
HP IIP Plus	945	1284	1475
HP Laserjet IIIP	1108	1446	1637
HP Laserjet IIID	2704	3042	3233
HP IIISI	3789	HP Paintjet XL 300	2397
HP Scanjet IIc with interface, PhotoFinish and OmniPage Pro Demo			1487
HP Scanjet IIp w/interface and Photofinish			899
HP Scanjet IIp with Photofinish and OmniPage Direct			1218

HP Laserjet Fax (plain paper send & rec.)	945	Lower Cassette Unit for HP / IIIP	168
HP II & III Envelope/Letter/Legal paper trays	59	AppleTalk Interface	239

HP Laserjet 4 with 2MB	**$1445**	**HP Laserjet 4M** with 6MB	**$1999**
HP Laserjet 4 with 6MB	**$1634**	**HP Laserjet 4M** with 10MB	**$2188**
HP Laserjet 4 with 10MB	**$1784**	**HP Laserjet 4M** with 14MB	**$2338**
HP Laserjet 4 with 14MB	**$1983**	**HP Laserjet 4M** with 18MB	**$2537**
HP Laserjet 4 with 18MB	**$2133**	**PostScript Level 2**	**$389**

LJ4 Memory Upgrades: 1MB $79 2MB $139 4MB $199 8MB $349

HP Laserjet 4 with LaserMaster WinJet 1200 1200 DPI **$2199**
HP Laserjet 4 with LaserPix 5.0 1200 DPI / 2400 DPI **$2839**

Scanners

Cuore The Typist+Graphics PC / MAC	379/445
Epson ES-600C / ES-800C	849 / 1165
Parallel Interface / SCSI Interface	299 / 345
Hewlett-Packard	See Box on this Page
Logitech ScanMan 256 (256 grays)	249
ScanMan 256 with Catchword Pro	299
ScanMan Model 32 (400 dpi, 32 grays) PC	135
ScanMan Color / Fotoman	579 / 493
Mustek PrinScan 105 handheld for laptop	189
Matador 105 400 dpi, 64 grays, w/ OCR	99
Mars 800 PD 800 dpi, 64 grays, w/ OCR	99
800 WP 800 dpi, 64 grays, w/ OCR, Win.	119
800 GP 800 dpi, 256 grays, w/ OCR.	149
800 GWP 800 dpi, 256 grays, w/OCR, Win.	169
M-6000 Color Artist Duo based with OCR	295
M-6000 Color Artist Windows with OCR	329
Mustek Color Artist Pro Win. with OCR	399
Gray Artist Plus sheetfed, 300dpi, 256 gray	424
Color Artist Plus sheetfed, 300dpi, color	619
Mars Color Flatbed 600dpi, 24 bit color	899
Microtek MS-II sheetfed with Omnitype	625
ScanMaker II+ 200dpi (interpolated res.)	899
ScanMaker IIXL with Photostyler	1178

We include a coupon for $75 when you buy Scanmaker II & OmniPage Direct, a coupon for $150 when you buy Scanmaker II & OmniPage Direct & auto document feeder.

ADF 800 auto document feeder	497
ScanMaker IISP 24 bit slide scanner	1475
UMAX UG-630 (600dpi, 256 grays)	829
UG-630 with Calera WordScan OCR	995
UG-630 w/WordScan OCR & doc. feeder	1323
UC-630 (600dpi, 24 bit color)	995
UC-630 with Calera WordScan OCR	1145
UC-630 w/WordScan OCR & doc. feeder	1543
UC-840 (800dpi, 24 bit color)	1295
UC-840 with Calera WordScan OCR	1595
UC-840 w/WordScan OCR & doc. feeder	1782
UC-1200 (1200dpi, 30 bit color)	CALL
UT-A Transparency Adapter	789
ScanOffice w/ Typereader, MS Pub., etc	859

Color Printers

DataProducts Jolt (1MB, solid inkjet)	4285
Jolt PS (6MB, solid inkjet, PostScript lvl 2)	5985
Fargo Primera (thermal wax printer)	799
Hewlett-Packard Paintjet / Paintwriter	788
Deskjet 500C / Deskwriter 500C	529
Deskjet 550C / Deskwriter 550C	729
Paintjet XL 300	2397
Paintjet XL 300 with 6MB total RAM	2695
Paintjet XL 300 with 10 MB total RAM	2881
IBM Lexmark 4079 Color Jetprinter PS	2899
NEC ColorMate PS Model 40	4695
RasterOps ColorPrint300 (dye-sub.)	CALL
Seiko Personal Colorpoint PSE	3449

PC Desktop Publishing

3G Graphics Images with Impact	CALL
Adobe Illustrator! competitive upgrade	199 / 179
Streamline for Windows	125
Aldus Pagemaker & free Adobe Type Mgr	479
Pagemaker Database Edition Supplement	148
Persuasion / Freehand for Windows	315 / 379
Gallery Effects / Intellidraw	129 / 195
Publisher's Showcase	659
Archetype Archetype Designer	549
Asymetrix Multimedia Toolbook	499
Bloc Development 3-D Charts to Go	69
Computer Support Arts & Letters Comp.	239
Arts & Letters Graphics Editor 3.1	399
Corel Draw for OS/2 or Unix	CALL
Draw 3.0 on CD-ROM (no diskettes)	358
Draw 3.0 5.25" or 3.5" with Free CD-ROM	359
Draw 3.0 Additional License	338
Draw 3.0 CD-ROM Competitive Upgrade	189
Draw3.0 Competitive Upgrade (disks & CD)	219
Deltina PerFORM Pro	139
Fractal Design Painter	275
Frame Tech. FrameMaker for Windows	549
Gold Disk Professional Draw	259
Insight Publisher's Prism (Color Seps)	489
Lotus Ami Professional 3.0	249
Ami Pro 3.0 Competitive Upgrade	99
Mathematica Tempra Pro	325
Micrografx Designer 3.1w/ ATM & ATA	369
Charisma	334
Photo Magic / Windows Draw	99 / 89
Picture Publisher 3.0	269
Picture Publisher 3.0 w/ Mars Color Artist	499
Microsoft Windows 3.1	89
Windows 3.1 with Logitech Dexxa Mouse	90
Word 5.5 including Grammatik	199
Word for Windows / Excel 4.0 Win	299 / 294
Publisher for Windows	129
Power-Up Express Publisher	99
Express Publisher for Windows	118
Quark Xpress for Windows	564
Rix Softworks ColoRix (VGA paint)	96
WinRix	288
Software Publishing Harvard Graphics 3.0	378
Spinnaker PFS: First Publisher 3	58
PFS: Publisher for Windows	96
Window Works (with free Pub. PowerPak)	79
Timeworks Publish It! v2.0 w/Design Ideas	147
Wordperfect Wordperfect/Drawperfect	258/269
Wordperfect Additional Station	168
Wordperfect for Windows	269
Writing Tools Group Correct Grammar	CALL
Xerox Ventura Publisher 4.1	499
Ventura Publisher 4.0 (Free Upgrade)	399
Ventura Database Publisher / Ad Pro	199 / 497
Ventura ColorPro / Picture Pro	605 / 568
Ventura Publisher 4.1 Network Node	288
Z-Soft PhotoFinish	118
Publisher's Paintbrush 2.0 (Windows)	249
PC Paintbrush Ver V+	69 / 112

Printers • Printer Upgrades

Adobe PostScript Cartridge for HP II	259
PostScript Cartridge for HP II with 2MB	398
PostScript Cartridge for HP II with 4MB	498
DataProducts LZR 1560 (11x17,400 dpi)	3285
DP-Tek TruePoint 600 DPI, - Canon/HP	599
Hewlett Packard Postscript Cart. Level I	389
Postscript Cart.+ Level II w/ATM, ATM+	497
Postscript Cart.+ Level II with 4MB	676
Deskjet 500 / Deskjet 550C	399 / 729
Transcend Memory for HP LaserJets	
HP II, IID 1MB/ 2MB/ 4MB	89 / 139 / 239
HP III, IIIP IIP 1MB/ 2MB/ 4MB	79 / 109 / 179
IBM 600 DPI lasers	CALL
LaserMaster WinPrinter 800	1485
Windjet 800 for HP / WinJet 1200	679 / 789
NEC SilentWriter 95 (Postscript, 2 MB)	1799
SilentWriter 95fx with PostScript Fax	1949
SilentWriter 97 (Postscript, 2 MB, 10ppm)	1799
SilentWriter 97fx with PostScript Fax	2348
NewGen Systems Turbo PS 880P	2089
Turbo PS/1200 B (1200 DPI, 11" x 17")	4889
Pacific Data Pacific Connect 256K	249
PostScript compatible upgrades	
Pacific Page for HP Series II w/2MB	369
Pacific Page II / XL for HPII w/4MB	779
Pacific Page for HP Series IIP / III / IID	268
Above item bundled w/2MB memory	377
Above item bundled w/4MB memory	447
PacificPage for the MAC (with LocalTalk)	469
Above item bundled w/2MB memory	578
Pacific Page XL PC / MAC	638 / 899
XL Upgrade for Pacific Page PE rev 4	397
Pacific Type Cart (requires Pac Page PE 4)	259
PacificTalk interface for MAC	199
ProTracer (360 DPI 17"x22" plotter/printer)	1339
ProTracer with HP GL & 5MB RAM	1589
PacificTalk Interface (for ProTracer)	177
PostScript Emulation (for ProTracer)	379
Sheet feeder I / II (for ProTracer)	119 / 109
QMS/Laser Connection PS-410	1489
PS- 815 MR (New 600 DPI printer)	3899
PS-860 (600 DPI, 11" x 17", 12 MB)	3999
Texas Instruments Microlaser Turbo PS 35	1599
XLI Printers & Upgrades See Box on this Page	

MultiMedia

Asymetrix Multimedia Toolbook	499
Canon XapShot	445
XapShot Imaging Kit	749
Creative Labs Sound Blaster Pro Basic	149
Sound Blaster 16	219
Sound Blaster / Sound Blaster Pro	95 / 179
Logitech FotoMan / Soundman 16	493 / 179
MacroMedia Action! for Windows	338
Media Vision Pro Audio Spectrum Plus	149
Pro Audio Spectrum 16	199
Thunder & Lightning	219
Microsoft Sound System for Windows	189

Scanning & OCR Software

Optical Mark Reading Software	CALL
Aldus Photostyler	499
Cuore OmniPage Direct	339
Omnipage Pro (includes Spell and Draft)	629
OmniType OCR for any Microtek scanner	269
The Typist+Graphics PC / MAC	379 / 445
Image Assistant	328
Pagekeeper	579
Calera WordScan / WordScan Plus	189 / 429
FaxGrabber	CALL
Expervision TypeReader	459
TypeReader & OCR scanner	699
TypeReader & OCR scanner & ADF	1049
Image-In Image-In-Color Pro	459
Image-In Color Pro full pack	695
Janet Hijaak Colorsep	369
Light Source Ofoto for Windows	259
Micrografx Picture Publisher 3.0	269
Recognita Recognita OCR	CALL

CD-ROM / Erasable Optical

Bloc CD Speedway	49
Creative Labs Multimedia Upgrade Kit	539
Multimedia Starter Kit	448
CD-ROM Upgrade Kit	379
Kodak Access Photo CD	31
Media Vision Fusion CD 16	499
Multimedia Upgrade Kit Plus	729
Pro 16 Multimedia System	979
NEC CDR 83 w/ XT/AT interface, 300ms	399
CDR-37, portable, 450ms, 150KB/sec.	399
CDR-84, internal, 280ms, 300KB/sec.	545
CDR-74, external, 280ms, 300KB/sec.	609
XT / AT interface	79
Multimedia Gallery	889
Philips CDD-521 CD recorder	5885
Pinnacle Micro PMO-650 Erasable Int.	3139
Pioneer DRM-604X 16 disc CD changer)	1399
Smart & Friendly CD-ROM Drives	CALL
Toshiba Photo CD compatible drives	CALL

ORDERING INFORMATION

Publishing Perfection™ Since 1987

- *If you find a better price, call before you buy!*
- Mastercard, Visa—no added fee, or COD.
- Please mention ad—many prices are specials
- Express overnight delivery on most software only $9.

1993

PHONE ORDERS call 1-800-327-8111 • FAX ORDERS TO 414-255-9640 (24 Hours)
CUSTOMER SERVICE and INTERNATIONAL inquiries call 414-255-7600
MAIL ORDERS: We accept private and company checks, but allow time to clear. For faster service send certified check or cashier's check. Please include a daytime phone number. Call for shipping cost.
We specialize in international orders! 220V and PAL products available! VAR and dealer inquiries welcome!
Mailing address: W34 N5490 Campbell Dr., P.O. Box 307, Menomonee Falls, WI 53051

SHIPPING: Hawaii, Alaska, and Foreign orders, call for shipping cost. Hardware: call for shipping cost.
All goods new and guaranteed by the manufacturer. Defective software replaced immediately. Defective hardware replaced or repaired at our discretion. All returns must be authorized. Due to copyright laws all sales are final. Because of the volatility of the computer industry, availability and prices subject to change without notice. International orders welcome.
For your protection we check for stolen credit cards.
In Hong Kong, please call our affiliate, Houston Crest Co. at 852 336 2073, FAX 852 736 7150.

PC M0393

800-327-8111

CIRCLE 314 ON READER SERVICE CARD

International, Wisconsin & Customer Service 414-255-7600
Phone hrs. M-F 8-5+, Sat. & Sun.–Call • FAX 414-255-9640

This Is The Only Hardware You Need To Shop The World's Ultimate On-Line Superstore.

Or Shop Us On :
PRODIGY®,
CompuServe,
GEnie, Delphi,
LA On-line,
America On-line
and many more!

50/50 DUAL DESKTOP

A revolutionary expansion board that converts IBM-PC compatible computers into a dual platform machine that can run DOS and Windows applications as well as Macintoch applications running under system 6 or 7. Run all Macintosh software that is compatible with the SE, Plus and Mac Classic such as Macintosh Word, Excel & Pagemaker, Photoshop, 4th Dimension, Illustrator, MacDraw, and virtually ALL others (B&W only)

Manufacturer: 50/50 Micro Electronics

$999

SoundMan 16 Quality Sound Board

The richest 16-bit stereo sound available! Gives you the best sound quality possible on your computer. An excellent choice for playing all your favorite games. 100% Sound Blaster and Ad Lib compatibility. Use to record, edit and play back sound in DOS and Windows. Even use music, voice and sound to add life to word processing, multimedia, spreadsheet, and other Windows™ 3.1 business applications

Manufacturer: Logitech

$185

Desktop TV

Turn your PC into a high-res TV with a touch of a key. Four times sharper than standard TVs on VGA monitor for safe close-up viewing.

Manufacturer: Visionex

$199

Managing Your Money & TaxCut with FREE Computer Check Ordering Kit

MYM is the most complete personal money manager. Pays bills, tracks budgets, manages investments, estimates taxes and even imports Quicken files. (Mouse support is included). **TaxCut** guarantees its calculations so you don't have to worry when you file your return. Easy-to-use interview asks you simple yes/no questions and completes all the correct forms for you, ensuring you all the deductions you're entitled to by law. **Publisher: Meca**

Get a $15 rebate when you buy Managing Your Money & TaxCut

$65

Free Movies March!

Chose one of these movies when you purchase any of these three games.

Publisher: Disney

ACT! for Windows™

ACT! for Windows™ integrates a powerful contact database, activity manager and calendar. It also includes a full featured word processor with spell-checker and mail merge capability and custom report generator. Each contact record has a unique history record and notebook attached. ACT! for Windows™ combines the planning, scheduling, follow-up and support of a personal executive assistant! **Publisher: Contact Software**

$249

Orders accepted on our toll free number Mon-Sat 8:30 to 5:30 EST. Visa, MasterCard, and Discovercard accepted. All credit card orders processed within 24 hours. Continental US shipments: UPS Ground $5, Airborne Overnight $7. Corp, Gov't, Educ, APO, FPO, International orders accepted. No sales tax except for Mass add 5%. Personal checks will delay shipment 5 business days. Products covered by manufacturer's guarantee. Defective software replaced immediately. No COD's. Item availability and price subject to change without notice. 15% restocking fee for non-defective returns.

CIRCLE 177 ON READER SERVICE CARD

800-228-7449

Fax: 508-443-5645

日本の皆様よりのオーダー大歓迎！ 日本語でFAX 1(011)-508-443-5645
又は、コンピューターサービスナンバー：I.D 70007,1514
で皆様よりのオーダーをお待ちし上げております

VISA

COMPUTER Express

The World's Ultimate On-Line Superstore

HARDWARE

Eastman Kodak 180ci Printer	299
Kodak Photo CD Player PCD 870	349
PS/Valuepoint 386SLC-25 170MB	1190
Citizen 145GSX Printer	429
Eastman Kodak 701 Inkjet Prntr	439
Casio KL-2000 Labeler	169
Citizen 130GSX Printer	279
PS/ValuePoint 486DX-33 212MB	1699
Casio SF-5300 Organizer	99
Casio SFR-20 Organizer 256K	269
PB/Valuepoint 486DX2-66 212MB	2550
PB/ValuePoint 486SX-25 170MB	1499
ATi Ultra Pro (ISA) 2MB	305
Watchit! TV for Windows	299
ProDesigner IIs SVGA 1MB	179
Diamond Speedstar 24x 1MB	199
Diamond Speedstar 24 SVGA	149
Scanman 256 w/Catchword Pro	299

MediaVision ProAudioSpectrm 16	179
MediaVision PAS16 MPC System	999
Chinon CDS-435 Internal Drive	333
Chinon CDX-435 External Drive	444
Sound Blaster 16	249
CD-Berlitz Think & Talk French	119
CD-Compton's Encyclopedia MPC	240
CD-Cinemania Movie Guide Win.	52
CD-MPC Wizard Diagnostic	12
CD-MPC Music Mozart	30
CD-Groler Encyclopedia Window	237
CD-Industry At Work Clip 2	199
CD-QuickArt Deluxe	249
CD-Clinton	35
CD-Corel Draw	449
NEW Sound Blaster Deluxe	95
Discovery Int. 16-bit MPC Kit	469
Win CD Professional	32
Autodesk MPC Explorer CD	119
Windows Sound System	199

TurboTax 1040 Final Windows	47
TurboTax 1040 Final DOS	47
Quicken 6.0/U.S. Atlas DOS	46
Bible Study	90
Micro Kitchen Companion DOS	30
Micro Kitchen Companion Window	30
ZodiacSigns	42
Managing Your Money/HomeLawyer	40

COMMUNICATIONS

Zoom VFXV32bis Ext. 14.4 FAX/M	249
Zoom VFPV32BIS Int 14.4 Fax/M	229
"Communications Pak Windows"	199
U-1496+ 16.8EXT 14.4FAX Window	610
U-1496B 16.8INT 14.4FAX Window	339
U-1496B+ 16.8EXT 14.4FAX Wind.	449
U-1496B 14.4INT 14.4FAX Window	310
SupraFaxModem V 32bis Ext DOS	330
Sportster 14400 Fax/Modem Int	330
VIVA 14400 Fax/Modem External	309
DOSFAX Pro	46

Paradox 4.0	519
Paradox for Windows	129
FoxPro 2.5 Competitive Upgrade	189
FoxPro 2.5 Windows OR DOS	395
FoxPro 2.5 Version Upgrade	99
Microsoft Excel 4.0 Windows	299
Lotus 1-2-3 Release 3.1 Plus	399
Lotus 1-2-3 for Home	95
Lotus 1-2-3 Release 2.4	335
Borland Quattro Pro Comp. Upg	99
Borland Dbase IV 1.5	469
Symantec Q&A	249

WORD PROCESSORS

Lotus Ami Pro For Windows	249
Lotus Ami Pro Windows Comp. Up	99
Lotus Write 2.0	129
WordPerfect 5.2 Windows	299
WordPerfect 5.2 Windows Upgrad	129

ACCOUNTING

SuperStor Pro for Windows	85
Stacker 3.0	99
After Dark Windows 2.0	30
Norton Utilities 8.01	110
Xtree Gold 2.5	89
Norton Commander for OS/2	99
Norton Antivirus	85
Norton Desktop 2.0 for DOS	115
Norton Desktop 2.0 for Windows	115
Fifth Gen. Direct Access	85
Fifth Gen. Fastback for Win	129
Central Point PC Tools 8.0	129
Windows Printing System	139
For Side Daily Planner 2.0	55
Hewlett Packard Dashboard	40
Hewlett-Packard NewWave	99
EzSound FX	39
SoundBits Around World Windows	27
SoundBits Cartoon Windows	27
SoundBits Classic Movie Window	27
Photo CD Access DOS	29
Photo CD Access Windows	29

GlobalLink To/From Eng/Spanish	179
Windows 3.1	95
Windows 3.1 Upgrade	49
MS-DOS 5.0 Upgrade	99

INTEGRATED

Commence	237
Lotus Works 3.0	95
Microsoft Works 3.0	92
Microsoft Works Windows 2.0	120
Lotus Organizer	99

BUSINESS GRAPHICS

PC Paintbrush Plus for Windows	99
Pickers Publisher 3.1 +OLE	259
MS TrueType Font Pack 1 Window	45
MS TrueType Font Pack 2 Window	45
Microsoft Access for Windows	310
Adobe Illustrator 4.0 for Win	399
Lotus Freelance Graphics 4.0	340
Corel Draw for Windows	379
Framemaker Windows	499
Micrografx Windows Draw	99
Graphics Works for Windows	139

MULTIMEDIA

Here are only a few of the 3,000 products we've delivered to our satisfied customers. Just call 1-800-228-7449 to start saving time and money with Computer Express!

COMPUCLASSICS

YOUR SOURCE FOR SOFTWARE

*FREE GROUND SHIPPING

- Over 9 Years Serving You
- Overnight Shipping Available
- 24-Hour FAX Order Line
- Int'l APO, FPO, Gov't and Educational Orders & POs Accepted
- Visa, MasterCard, Amex & Discover (No Surcharge on U.S. Orders)
- Over 10,000 Titles Available
- Corporate POs Welcome
- No Minimum on Individual Orders

ACCOUNTING

Accpac BPI Integrated 4.0	289
Managing Your Money 9.0	49
Peachtree Network Accounting	309
Quickbooks	89
Quicken 6.0	44
MYOB Accounting For Windows 3.0	155
Peachtree Accounting for Windows	79

CAD

AutoSketch 3.0	95
Design Cad 2D 6.0	179
Design Cad 3D 4.0	250
Generic Cadd 6.0	289
Drafix Cad for Windows 2.1	446

COMMUNICATIONS

Carbon Copy 6.1	135
DosFax Pro 2.0	49
Laplink Pro 4.0	105
PC Anywhere (Host & Remote) 4.5	119
Reflection 4 Plus 4.2	299
CC Mail Windows Platform Pack 1.11	359
Close Up Suppt. Cust Windows	129
Crosstalk For Window 1.2	119
ProComm Plus for Windows	105
Reflection 2 Windows	239
Winfax Pro 3.0	82
Hayes Optima 144 W/SCEZ V.42 BIS	475
Intel Satisfaction 400 Internal	439
Quicktel 2400 Modem	39
Workport 2496 Fax Modem V.42 BIS	269
Zoom 9624 S/R Fax Modem Internal	105

DATABASES

Accumail	175
Alpha, Four Comprehensive Upgrade 2.1	99
Blaiker 2.0	249
Clipper 5.2	489
Codebase 5.0	249
Dbase IV 1.5	499
Funcky Lib 2.0	429
MS Foxpro LAN 6 Pack 2.5	599
MS Foxpro Single User 2.5	519
R & R Relat / Report Writer XBase 5.0	175

DESKTOP PUBLISHING

By Design	59
InfoniType Plus	59
InfiniType Vol. I	54
Moreforms 3.01	75
Print Shop Deluxe	49
Scanman 256	294
Ultrascript PC	112
Adobe Type Mgr For Win 2.02	69
Akus Publishing Showcase	699
Bx Design for Windows	59
Fontographer	265
MS Hewlett-Packard Font Set 1.0	52
Omnipage Professional 2.1	649
Pagemaker 5.0	599
Pagemaker 4.0	499
Quark Express 3.1	595

ENTERTAINMENT

Amazon: Guardians of Eden	45
Barbie PC Design	25
Design Your Own Railroad	42
King's Quest VI	52
Links 386 Pro	44
Science Adventure	55
Wing Commander IV	47
Chessmaster 3000 For Windows	43
MS Entertainment Pack 1 (1 IN Pr Ea.	33
Sumcity For Windows	37
Sumearth For Windows	42

FORMS/FLOWCHARTING

Easyflow 2.0	165
Flowcharting III	142
Formtool Gold 3.0	55
Org Plus Advanced 6.0	64
ABC Flowcharter 2.0	309
Org Plus Adv For Windows	129
Perform Pro Plus	251

GRAPHICS

Dan Bricklin Demo II	199
Freelance Competitive Upgrade 4.0	105
Freelance Graphics 4.0	335
Harvard Graphics 2.3	359
Harvard Graphics 3.0	419
Presentation Task Force 4.0	134
Adobe Illustrator Windows 4.0	469
Adobe Illustr. Windows Upgrade 4.0	189
Corel Draw Windows 3.0	399
Fractal Design Painter for Windows	272
Fractal Sketcher	99
Hijaak for Windows 1.0	129
Micrografx Designer w/ATM 3.1	399
Micrografx Windows Draw 3.0	105
Stamford Graphics	369

INSTRUCTIONAL

Bodyworks: Adventure in Anatomy	45
Orbit	35
PC Globe 5.0	39

INTEGRATED

MS Works 3.0	99
Siegwerx	52
Lotus SmartSuite	489
MS Office For Windows 3.0	495
MS Works For Windows	135

LANGUAGES/PROGRAMMING

MS Visual Basic Dos Professional	349
MS Visual Basic Dos Standard	135
Object Professional Turbo Pascal 1.14	129
Turbo C++ 3.0	69
Turbo Professional 5.12	89
Borland C++ 3.1	349
Borland C++ W/Appl Frmwrk 3.1	525
MS C/C++ 7.0	319
MS Visual Basic 2.0	129
Smalltalk Windows	309
Turbo C++ for Windows 3.1	109
Turbo Pascal for Windows 1.5	109
Win ++	175

MULTIMEDIA/CD-ROM

Grolier's New Electronic Encyclopedia	229
Just Grandma and Me	39
Multimedia Upgrade Kit Plus Internal	279
Pro Audio Spectrum 16	209
SS-700 Speakers	42
Sound Blaster 16 ASP	259
Sound Blaster Pro MultiMed Upg Kit Int	479
Sound Blaster Professional	199
Autodesk Multimedia Explorer	125
MS Cinemania	59
MS Encarta Encyclopedia	276
MS Multimedia Bookshelf For Win	135
MS Musical Instruments	59

NETWORKING

Etherlink III	145
Etherlink III (5-Pack)	662
Lantastic AE 2 Ethernet Adapter 4.1	215
NE 2000 16 bit Without Cable	149
Novell Netware	Call
SMC Ethercard Plus Elite 16	149
Xircom PE2-10B2 (New Tractor)	289

OPERATING ENVIRONMENTS

Desqview/X	175
IBM OS/2 2.0	142
HP New Wave 4.1	109
MS Windows 3.1 & DOS 5.0 Upgr	145

PERSONAL INFORMATION

Automap	54
Automap Europe	79
Dr. Schueler's Home Medical Advisor	49
Infoselect 2.0	99
Automap For Windows	54
Packrat 4.3	245

PROJECT MANAGEMENT

Milestones ETC	175
MS Project for Windows 3.0	455
Timeline For Windows	469

SPREADSHEETS

Lotus 1-2-3 3.4	399
Lotus 1-2-3 2.4	339
Lotus 1-2-3 Upgrade 2.4	105
Lotus 1-2-3 Upgrade 2.4	105
Quattro Pro Competitive Upgrade 4.0	97
Lotus 1-2-3 Windows 1.1	335
Lotus 1-2-3 Win Comp Upg 1.1	105
MS Excel For Win Comp Upgr 4.0	127
Quattro Pro WinDOS	309

STATISTICS/SCIENCE

DrawMaker 2.5	142
CSS: Statistica	635
Derive 2.5	135
Grapher	145
Mathcad 2.5	325
Mathematica 386 w/387 Support 2.1	749
Mathematica Graphics	
Sigma Plot 5.0	435
Sistegraphics 5.1	709
Surfer	359
Systat 5.0	739
Grapher for Windows	169
Mathcad 3.1	325
Mathematica For Windows 2.1	835
Systat Windows 5.0	739

UTILITIES

386 Max 6.02	64
Automenu 4.7	43
Check 'n Plus	85
Checklist Dos	59
Disk Manager (DOS) 5.1	39
Dr. Solomon's Anti-Virus Toolkit	67
Norton Desktop For DOS 1.0	85
Norton Utilities 6.01	115
PC Kwik Powerpak 3.0	84
PC Tools 8.0	133
Power Menu Plus 6.0	61
Printcache 3.0	95
Q DOS 3	62
QEMM 386 6.02	62
Sidekick II 3.0	82
Stacker 3.0	95
Superstor 2.0	59
Superstor Pro 2.0	89
System Sleuth Pro 4.0	99
XTree Gold 2.5	99
Xtradrive Data Compression	45
Checklist Dos/Windows	76
Fastback Plus Windows	126
Norton Antivirus For Win/DOS 2.1	89
Star Trek Screensaver	55
Wordsleuth Gold	99
Xtree for Windows	67

WORDPROCESSING

Language Assistant - Spanish 5.0	59
PrimeType for Wordperfect	66
Wordperfect 5.1	272
Ami Pro Competitive Upgrade 3.0	105
Grammatik 5 Windows	58
MS Word For Windows Upgrade 2.0	127
Wordperfect 5.2 To Windows Trd-Up	85

HARDWARE

INT DX33 Math Co-Processor	78
INT DX40	88
INT SX25 Math Co-Processor	68
INT SX33 Math Co-Processor	78
Colorado DJ 20	279
Iomega Tape250 Insider H/H	279
XGraphics	240
Appoint Gulliver	69
Logitech Mouseman Serial/Bus	75
Canon Bubblejet BJ-10ex (black)	307
Canon Bubblejet BJ-70 (black)	419
Canon Bubblejet BJ-300	465
Canon Bubblejet BJC-800 (Centronics)	2015

Indicates Windows Products

WE DELIVER THE SUPERSTORE TO YOUR DOOR!

Lotus 1-2-3

Now when you buy the Lotus 1-2-3 for windows upgrade, get either Freelance or Ami Pro at the upgrade price, and the new Intex Tax Solver for free, just in time for tax season! The Intex Tax Solver provides all tax filers with the most comprehensive selection of IRS forms and schedules, with all formulas and links in place and ready to use.

$335

Stanford Graphics

NEW! Stanford Graphics for Windows is the most powerful and versatile graphing and presentation package available...and it's surprisingly easy to use. Choose from over 167 graph types for business, statistical and technical data. You can even analyze and manipulate your data with over 70 built-in statistical functions. Order now and receive 48 free TrueType fonts with your purchase of Stanford Graphics.

$369

CA-Clipper

CA-Clipper is a premier application development system and database. It consists of a robust language, an efficient linker, flexible preprocessor & high-performance compiler. Together with tools such as an editor, debugger and make utility, there elements form a complete system for the creation and distribution of professional PC and LAN-based applications.

$489

HiJaak For Windows

Converts, captures, views, enhances, and prints images. Support for 24 raster formats (plus hundreds of TIFF "flavors"), 16 vector formats, and 25 popular fax card formats.

Captures graphics screens from Windows and text and graphics screens from DOS applications.

$125

Microsoft Office

Microsoft Word 2.0, Micro-soft Excel 4.0, Micro-soft Powerpoint 3.0 and Micro-soft Mail all for Windows working together! It's about sharing information easily from one application to another. Run all four applications at once. Move and link inofrmation easily between programs to get the most out of your work.

$495

COMPUCLASSICS

P.O. Box 10598, Canoga Park, CA 92309
Showroom: 7959 Deering Ave., Canoga Park, CA 91304

CALL US FOR PRODUCTS NOT LISTED
PLEASE SPECIFY DISK SIZE WHEN ORDERING

*UP TO 10 LBS. 48 hour delivery $7.00 per order up to 7 lbs. $1.00 per pound above 7lbs only in the Continental United States. Alaska, Hawaii, Puerto Rico, Intl, FPO/APO call for shipping charges. Defective software will be replaced immediately. 15% restocking fee on non-defective items. Prices subject to change without notice. We ship latest versions. Please call (818) 347-9400 for an authorization number on returns. $5.00 C.O.D. charge. Order desk open at 7 am to 5 pm Monday through Friday (PST), Saturday 10 am to 2 pm. 24 Hour FAX Order-Line.

800-827-1994/818-347-7500/FAX 818-347-9977

CIRCLE 205 ON READER SERVICE CARD

SPECIAL! Wordperfect 5.1 $249

Greater Inventory! Faster Service! Outstanding Technical Department!

1-800-438-6039

Network

3COM
- 3C503 Etherlink II/ 5-pack 185/759
- 3C503TP 10 Base T 229
- 3C507 Etherlink 16 279
- 3C523 MCA Ethernet 299
- NEW! 3C619 479
- NEW!3C509 149

ARTISOFT
- Starter Kit 2mbps/AE2 ..... 325/449
- Starter KitAE3 539
- Lan Cards 2mbps/AE2 ..... 129/199
- Lan Card AE3 229
- Central Station 419

INTEL
- Ether Express 16/16TP 119
- Token Express 16/4 ISA/MCA 499
- EtherExpress EISA 539

NOVELL
- NE1000/NE2000 ..... 99/135
- NE 3200 669
- Novell Lite 1 1/starter kit 69/409
- Netware 2 2 5/10 User 509/1079
- Netware V 2 2-50 user 2199
- Netware 3 11 5/10 User 599/1399
- Netware 3 11-50 User 2739
- Netware 3 11-100 User 3775

SMC
- PC130/PC130E 79/99
- PC600WS/PC600FS 129/209
- Ethercard 8 bit/16 bit 119/139
- 10 Base-T Card 8 bit/16 bit. . 145/165
- 3608TP 10BT concentrator 389
- 3512TP Ether 10BT conc 12 port 709

XIRCOM

CALL FOR OTHER NETWORK PRODUCTS

Network Software

- Borland D Base IV LAN-1 user 279
- Foxpro Lan 6 user 559
- Lotus 2 4 server/node 559/339
- Lotus 3 1 server/node 625/409
- Norton PC Anywhere V.4.5 Lan 325
- Peachtree Network Accounting 295
- Word Perfect additional nodes 179

Software

- Aldus Pagemaker 489
- Carbon Copy/Close Up 129/119
- Clarion ProDeveloper 449
- Clipper 5.0 479
- Corel Draw 365
- Dbase IV 1 5 409
- FoxPro 2 5 309
- Framemaker 549
- Freelance Plus 309
- Harvard Graphics 369
- Lotus 2 4/3.1 + ... 329/379
- NEW! Lotus 3 4 389
- Lotus for Windows 415
- Smart Suite Bundle 449
- Microsoft Windows 3.1 89
- Microsoft Windows for Workgroup CALL
- Microsoft Windows NT ..... CALL
- Microsoft Access 1 0 for Windows CALL
- Microsoft Excel 4 0 for Windows . . 309
- Microsoft Word for Windows 299
- Norton Desktop for Windows 94
- Norton Utilities 6.01 115
- Norton AntiVirus 89
- Peachtree III Complete DQ 189
- Paradox v4.0 ..... BEST PRICE!
- Q&A 4.0 219
- Quattro Pro 299
- Stacker 3 0 95
- Ventura Desktop Pub . . BEST PRICE!
- Winfax Pro ..... [illegible]
- Word Perfect 5.1 249
- Word Perfect 5 2 for Windows 259

DON'T SEE WHAT YOU NEED? PLEASE CALL!

Notebooks

TEXAS INSTRUMENTS
- 4000 SX25 W/120 2349
- 4000 DX25 W/120 2835
- 4000 DX25 W/200 3129
- 4000 SX2/50 W/200 3379

MITAC
- 386 SL25, 2mg 60mg/80mg 1199/1299
- 486 SL33, 4mg 80/120mg 1730/1849

EPSON
- NBSL-20/25 ..... 1525/1775
- w/ 60/80/120 MB HD 309/549/755

Monitors

NEC MULTISYNC
- 3FGX/4FG 669/769

PANASONIC
- 1381/1395 ..... 319/429
- NEW! C1745E 1359

SAMSUNG
- Syncmaster 3 14" 1024 x 768 299
- Syncmaster 4 17" 1024 x 768 759
- Syncmaster 15 15" 1024 x 768 .. 479
- Flatwhite MC4571 14" 119

CTX
- 5468/5468NI 289/325
- 3436 Multiscan 28 399
- 1760 17" SVGA 815

NANAO
- F550i/T560i 1149/1899
- NEW! F340i ..... CALL!

VIEW SONIC
- 6/6FS/7 ..... 369/629/1069

MAG
- CALL!

Video Cards

ATI
- Graphics Ultra + 1 meg 29
- Graphics Ultra Prof w/ 1 mg 43
- Graphics Vantage w/ 1 mg 22
- VGA Integra 512K 8

BOCA
- Basic VGA ..... CALL!
- Super VGA 1 mg ..... CALL!
- Super VGA 1 mg 16.8 mil colors call!

DIAMOND
- Diamond Speedstar 24x w/ 1 mg 189

ORCHID
- Prodesigner IIS/EISA w/ 1 mb 319
- Prodesigner IIS w/ 1 mb 159
- Orchid Fl280 w/1 mg 249

Modems & Fax

BOCA
- 2400 int/ext ..... call
- 2400 v42 bis int/ext ..... call
- 24/96 fax modem int/ext ..... call
- 14 4 fax modem int/ext ..... call

CARDINAL
- 2400 INT/EXT 59/84
- 2400 INT/EXT w/MNP 89/99
- 9600 INT/EXT 249/279
- 96/24 INT Fax/modem 89

HAYES
- Optima 96 339
- Optima 14.4 EXT/fax 499

INTEL
- Satisfaction 400/400E. 399/459

PRACTICAL PERIPHERALS
- FAX ME 185
- PM 14400 FXPPM Pocket Mod ... 359
- PM 14400 FXMT ext v 32 bis ..... call
- PP 9600 int/ext 269/279

US ROBOTICS
- Sportster 14.4 fax/modem int/ext 349
- Courier HST Dual 16.8 759

Printers

CANON
- BJ10ex/20/200 ..... 279/399/369
- BJ300/330 ..... 399/599
- LBP-4ex laser 949
- LBP-8ex laser 1379

DICONIX
- 150si inkjet 299

EPSON
- AP 2250/3250 ..... 155/189
- FX870/FX1170 ..... 365/949
- LQ570/LQ1070 ..... 339/749
- LQ870/LQ1170 ..... 425/575
- LQ2550 849
- EPL6000 laser 1099
- DFX5000/8000 ..... 1269/2139
- Action Laser 1000/1500 ..... 669/call

HEWLETT PACKARD
- Laserjet IV w/ toner 1999
- Laserjet IIP+/IIIP 809/call
- Laserjet IIIsi w/ toner 3299
- Desk Jet 500/500c 399/509
- Desk Jet 550c 729

OKIDATA
- ML184/380 ..... 229/219
- ML320/321 ..... 309/425
- ML590/591 ..... 429/579
- 393/393c 819/979
- laser 400/ETO 599/1064
- 830/840 ..... 1269/call
- PM3410 1239

NEC
- Silentwriter 95lx 1999
- Silentwriter 97 1629

PANASONIC
- 1123/1124i 199/275
- 1624/1654 ..... 329/539
- 2180/2123 ..... 175/255
- 2124/1695 ..... 319/369
- 2624 24 pin wide 379
- 4410 laser/4430 ..... 639/1079
- 4451/4455 ..... 1199/1719

LASER ACCESSORIES
- Upgrade for HP 1 mb 79
- Upgrade- HP 2mb/4mb 109/179
- Pacific Data 25-N-1 249
- Pacific Page PE/PEXL call/699
- Pacific Connect XI ..... call
- Complete Font Library 249
- Font Bank Cartridge 1.5 Mb 269

Mice & Misc

- Epson ES600C/800C scanners ..... call
- Microsoft Mouse w/Windows 3.1 ... 149
- Microsoft Ball Point Mouse 118
- Logitech Scan Man 256 w/ OCR .. 319
- HP Scanjet IIP w/interface 699
- HP Scanjet IIC w/interface 1489
- Soundblaster Pro 16 ..... CALL

AMERICAN POWER
- Back-ups 250/400/450 . 109/169/199
- Back-ups 600/900 ..... 279/389

Bulldog Systems

Building a Standard Configuration

Dual Floppy Drives • Super VGA Card with 1 Mg • 14" SVGA Monitor (1024 x 768) • DOS 5.0 • Windows • Mouse • 1 year warranty!

386-SX/33 w/ 4 MB w/ 80 MB HD . 1199

386-DX40 (64K CACHE) 4MB , 120HD

$1349

486-33 (256K CACHE)4MB 210MB HD

$1729

486-DX50(256K CACHE) 4MB 210MB HD

$2040

Call for other configurations

Drives

CONNER
- 40mg IDE/85mg IDE 149/209
- 120mg IDE 3-5/200IDE 3.5 . 245/349

IOMEGA
- 90 MB Insider/Transportable 579/689
- Dual 90 ext 1495
- NEW! Bernouli Multidisk 150 ..... call!
- Tape 250 mg insider 259

MAXTOR
- 7120A 130 IDE 259
- 7213 A 210 IDE 349
- 7245 A 245 IDE 349

QUANTUM PASSPORT XL removable
- 120MB/240MB 699/869

SEAGATE
- ST3096A /3144A 209/259
- ST3283A 245mg IDE 499

FLOPPY DRIVES
- 1 2MB/1 44MB 59

Tape Drives

IRWIN
- Accutrak 120/250 ..... 189/239

COLORADO MEMORY SYSTEMS
- DJ10 120 Meg Int Jumbo 155
- DJ20 250 Meg Int Jumbo 239
- Trakker 120/250 ..... 355/439

MICRO SOLUTIONS
- 60/250 Backpack 429

Memory Boards

AST
- Six Pack 286 w/0K AT. 95

ORCHID
- Ramquest 8/16 w/0K XT/AT 129

BOCA BOARDS

CALL!

MathCo

INTEL
- 386 SX or DX 89
- OVERDRIVE SX20/25 379
- OVERDRIVE DX25/33 619

CYRIX
- 386SX 77
- 386DX33/40 ..... 95/119

P.O. Box 1459 • 610 Industrial Park Drive
Evans, Georgia 30809
OPEN weekdays: 8:30 a.m. to 7:30 p.m.
Saturday: 9:00 a.m. to 2:00 p.m.
(706) 860-7364 • FAX (706) 860-7358

BULLDOG COMPUTER PRODUCTS

No charge for credit cards. Shipping and handling extra (minimum $10; APO & FPO addresses additional 5%). Product warranties, offers, and claims are handled by the manufacturer. DOAs replaced or replaced at our option during the first 30 days only. No returns on used items. All returns of items are subject to a 15% minimum restocking fee. Defective software replaced with same item only. Call 706 860-7364 for a Return Authorization number prior to returning any product. Shipping charges are non-refundable. Bulldog cannot guarantee compatibility. All prices are U.S. and are subject to change and availability. GA residents add sales tax.

Visa | Discover | American Express | Master Card

CIRCLE 015 ON READER SERVICE CARD

MEMORY AND MORE...

Personal Computer Memory

IBM

PS/1 286, 386SX
2MB 92F9935 ..... $79 4MB 92F9604 ..... $149
PS/1 Consultant, Essential & Expert models x42, x44 &
PS/Valuepoint All models except C2x series
4MB P/N HA ..... $159 16MB P/N HA $379
PS/1 Consultant, Essential & Expert models x76
16MB Kit P/N HA $579
PS/2 25/286, 30/286, & memory adapter 1697250
2MB Kit 90F5566 ..... $79
PS/2 35SX; L3, 40SX, 50Z, 55SX; L5, 65SX; L5, 70, & 95Station
1MB 64F6605 or 90X8626 ..... $49
2MB 64F6604 or 90X8625 ..... $75
PS/2 70-A21; A61; E21; E61, PS/1 Consultant, Essential &
Expert models x71, x73 & x45, PS/Valuepoint C2x series
2MB 64F6606 ..... $75
PS/2 35SX; L5, 40SX, 55SX; L5, 65SX; L5, 95Station, PS/
Valuepoint C2x series & adapter board 54F3011 or 54F3077
4MB 54F2935 or 87F8077 ..... $159
PS/2 35SX; L5, 40SX, PS/Valuepoint C2x series
8MB 64F6129 ..... $299
PS/2 90 XP, 95 XP, P75 (pairs), 56, 57 (all), PS/1 Pro 2125
2MB 64F6062 ..... $89
PS/2 90, 95 XP, P75 (pairs), 56, 57 (all), PS/1 Consultant,
Essential, Expert x71, x73 & x45, PS/1 Pro 2133, HS/6000
4MB 64F6128 ..... $159 8MB 64F6130 ..... $299
Expansion boards for 50, 50Z, 55SX, 60, 65SX
2-SIMM w/2MB 1697250 ..... $269
Expansion boards for all models 70 & 80
2-14MB w/2MB 54F3077 ..... $329

NEC

PowerMate 286/12; SX/16 & SX/20
2MB Kit OP-410-0105 ..... $99
PowerMate SX/20
2MB CPU Upgrade OP-410-0101 ..... $189
2MB Exp. Board OP-410-0102+0105 ..... $299
PowerMate 386/33E & 486/25E
2MB OP-410-0101 ..... $189

Hewlett-Packard

Vectra 386/16N, 386/20N, 386/25N PC
2MB D2406A $99
8MB D2404A $319
Vectra 486/PC; 25T; 33T; 486s/20; 486/25N; 33N; 50N; 66N
2MB D2501A ..... $89 8MB D2152A $309
4MB D2151A or D2156A $169
Vectra 386/25; 486/25N; 486/33N; 486/50N; 486/66N
2MB D2501A ..... $89 8MB D2152A $309
Vectra 486/25N; 486/33N; 486/50N; 486/66N
16MB D2576A $579

Compaq

ProLinea 3/25c; 3/25cs
2MB 149758-001 ... $89 8MB 161742-001 ... $289
ProLinea 4/25s, 4/33, 4/50
16MB 161682-001 ... $39 8MB 161685-001 ... $89
4MB 161684-001 ... $159 8MB 161685-001 ... $309
DeskPro 386-20, 20e & 25
4MB 112532-001 ..... $169
DeskPro 386s/16
8MB 112534-001 ..... $169
DeskPro 286N; 386N; I Series; 386S/20; 20N; Portable
ASMC; M Series expansion boards; SystemPro LT Series
1MB 116600-001 ... $49 2MB 116600-001 ... $79
4MB 116590-001 ... $159 8MB 112577-001 ... $329
DeskPro 386-33, 486-33 & SystemPro
2MB 112544-001 ... $99 8MB 116591-001 ... $289
DeskPro 386N, 486N, SystemPro LT (32-Bit Exp. Board)
2-64MB w/2M 129160-001 ..... $519
DeskPro 386/33L, 486/33L, SystemPro
& Socket 3rd w/2MB 112160 + 112544-001 ..... $589

DELL

Power Desktop 325D & P, 333D & P, 433P, 486P & 486D
1MB 310-2505 ..... $59
4MB 310-2507 ..... $169
PowerLine Workstation 320; 25; 33; 33C; 450DE/2 & 486DE
2MB 310-2466 ..... $119 4MB 310-2467 ..... $199
8MB 310-2468 ..... $349 16MB 310-2469 ..... $669

Zenith

Z-300/400 Series Z-420/SX, Z-425/SX, Z-433/DX, Z-433/SX
4MB MK-100 ..... $159 16MB MK-90 ..... $599
Z-Server 425SX, 433DX, 450DE
4MB MK-432 ..... $179 8MB MK-902 ..... $329
16MB MK-442 ..... $649 32MB MK-92 ..... $1259
Z-Station 325Sx, 420SLE; SX; Sx, 425Sx, 433Vde; DX,50XDe
1MB MK-70 ..... $49 4MB MK-100 ..... $149
Zenith 2-386/20; 25; 25 & 33E
1MB Z8530001E ..... $49 4MB Z8530004E $199
Zenith Z-386SX/20, 20MP+, Z-IS
2MB Kit Z-405-1 ..... $89
Zenith 486/33ET; 25E
4MB Z0420002 ..... $199 16MB Z0420003 ..... $599

AST

Bravo 386-SX, MS/286, 386
2MB 500910-002 ... $89 8MB 500910-008 ... $179
Bravo 3/25i
2MB 500710-004 ... $99 8MB 500826-002 ... $319
Bravo 3/33i
2MB 500962-001 ... $75 8MB 500962-003 ... $339
Bravo LC 4/25i, 4/33, 4/33i, 4/50i, 4/66
4MB 500987-002 ... $149 8MB 500987-005 ... $289
16MB 500987-004 ... $589 32MB 500987-005 ... $1159
Premium 386/25; 33; 33T, Premium II 386SX/16; 20; 25
1MB w/BPS 500780-003; 002 ..... $59
Bravo 4/33; 486/25; Premium 4/25; 33TE; Server SE 4/33
2MB w/BPS 500710-004; 780-005 ..... $119
Power Premium 3/33, 4/33, 4/33i, 4/50i, 4/66, Premium
386/33TE, 486/25, 25E, 25TE, 33, 33E, 33TE, Premium II 3/25,
33, 486/33, 486SX/20 & Server SE 4/33
4MB 500780-004 ... $145 8MB 500780-001 ... $289

DEC

DECstation 3 series 5E; C; Plus; & 425c
2MB PCXAM-CB $99
DECpc 400ST series
4MB PCXAM-CC ..... $199 8MB PCXAM-CD $299

We also stock memory for most discontinued systems!

Kingston TECHNOLOGY CORPORATION

286 & 386 Processor Upgrades

CPU Upgrades (CPU socket) from 286 to 386SX
25MHz SX/Nmol ..... $299 33MHz SX/Nmol $329
Add a math coprocessor for $75

From 386 to 486
25MHz 486SX/Nmol $429 33MHz 486SX/Nmol $749

MicroMaster Upgrades (expansion slot)

From 286 & 386 to 486
25MHz 486SX MicroMaster $629
33MHz 486DX MicroMaster $1299

MicroMaster with 32-bit 70ns Memory
25MHz 486SX w/4MB $909
w/8MB ..... $1079 w/16MB $1619
33MHz 486DX w/4MB $1439
w/8MB ..... $1919 w/16MB $1969

Megahertz CORPORATION

Laptop & Notebook PCMCIA Fax/Modems
for AST, Compaq, IBM, Sharp, TI, Toshiba, Zenith and many other Laptop & Notebook Systems

PCMCIA 2.0 FAX/Modems with XJACK
14,000bps FAX/Modem, Cellular, Autosync ..... $Call
24/9600bps FAX/Modem ..... $Call

Internal FAX/Modems w/MNP-5 & V.42/V.42bis
14,000bps FAX/Modem, Cellular, Autosync $549
96/9600bps FAX/Modem $499
24/2400bps FAX/Modem $229
2400bps Modem $149

External Pocket Modems for any RS-232 Serial Port
14,000bps FAX/Modem, Cellular, Autosync $489
9600bps FAX/Modem $389
24/9600bps FAX/Modem $229

Laptop & Notebook Memory

AST

PowerExec 3/25SL, 3/25SL-C
4MB $179
16MB $1529
Premium Exec 386SX/25, 25C
1MB $49
4MB $129

Compaq

Contura 3/25; 3/25 & 25c
4MB $109
8MB $319
LTE 286
2MB $89
4MB $199
LTE 386s/20
4MB $189
LTE Lite 20; 25; 25C
2MB $189
4MB $229
SLT 286
1MB $99
4MB $279
SLT 386s/20
1MB $89
4MB $199

IBM

ThinkPad 300
2MB $159
8MB $429
PS/2 CL57SX & ThinkPad 700; 700C
4MB $219
8MB $369
ION Notebook (All)
2MB $179
4MB $249
L40SX & N33SX Laptop
4MB $155
8MB $285

NEC

UltraLite & Cellular Workstation 286F
1MB $189
4MB $389
UltraLite & Cellular Workstation SX/20
2MB $179
8MB $389
UltraLite MX, SL/25C
2MB $199
4MB $389
UltraLite SL/20, SL/20F
2MB $199
8MB $259
ProSpeed 286, 386SX/16
4MB $169
8MB $299
ProSpeed 386
2MB $149

Panasonic

CF-170, CF-270, CF-370
1MB $89

Texas Instruments

TravelMate 2000
1MB $89
2MB $79
TravelMate 5000, WinSX
4MB $199
TravelMate 4000

Toshiba

T1000SE/LE/XE; 2000; 2000SX/SXs;
2MB $85
T2200 & T4900 Satellite Series
4MB $159
8MB $299
T1200XE, 1960, & T4900
2MB $89
T3100SX, 5200SX, & SXC Portables
2MB $99
4MB $149
T5200
4MB $149
T5200SX, NoteDuo
2MB $159
4MB $179
T4400 & T6400, SX, SXC Notebook
2MB $159
4MB $179
8MB $349
T5100
2MB $85
T5200; T5200C & T4500
2MB $82
4MB $279

Zenith

Z-Note Notebook (all models)
2MB $169
4MB $349
Z-Sport 325S
2-4MB $159
Z-Sport 425S & 425SX
4MB $189
MasterSport 386SL, SLC, SLe
2MB $99
MasterSport 386SX
2MB $169
SuperSport SX; 20MX; SlimsPort
2MB $169
SuperSport 20MC; SlimsPort
4MB $279

Grid

1450ex
2MB $149

Magnavox or Packard Bell

286 & 386SX Notebook
4MB $189

Sharp

PC-6220 Notebook
1MB $169

Sonyo or Zeos

Notebook Memory
2MB $79

Everex

Tempo LX Notebook
2MB $79
Tempo Carrier Notebook
2MB $119

Laser Printer Memory

Compaq PAGEMARQ 15 & 20
8MB 126561-001 .. $329 16MB 126361-001 .. $649
Hewlett-Packard LaserJet IIISi, 4, 4M & 4SiMX
4MB C2065A ..... $149 8MB C2066A $299
Hewlett-Packard LaserJet IIP, III, IIIP, IIID
2MB 33475B ..... $99 4MB 33477B $159
Hewlett-Packard LaserJet II & IID
2MB 33444B ..... $92 4MB 33445B $169
Hewlett Packard DeskJet 500, 500C
256K 2270781 ..... $59
IBM Laser 4029 All Models
4MB 1103335 ..... $129
Canon LBP-4, 4Lite, 4Plus
1MB S63-2250 ..... $119 2MB N/A $169
Canon LBP-III & 4Ite Plus
2MB S63-2350 ..... $249 5MB S63-2360 ..... $299
Panasonic 4410 & 4420
2MB KX-P4411 ..... $109 4MB N/A $179
Panasonic 4450i & 4420
2MB KX-P4451 ..... $119 4MB N/A $199
OkiLaser 400
1MB 70014701 ..... $79 2MB OKI N/A $99
Texas Instruments MicroLaser & XL
1MB 2555730-0001 ..... $49
Epson EPL 6000
2MB 1B5401 ..... $99 4MB N/A $189
Epson ActionLaser II, EPL-8000
2MB N/A ..... $169 4MB N/A $259

Expansion Boards

BOCA RESEARCH INC.

Memory Boards for any 286 or 386!

BocaRam AT Plus: 2-MEG memory board for BOCA & IBM AT compatible machines running up to 33MHz. Get conventional, expand, (LIM EMS 4.0) and/or extend. memory, OS/2.
including 2MB ..... $169 including 4MB $229
including 6MB ..... $299 including 8MB $369

Memory I/O Boards

BocaRam AT I/O Plus: 2-MEG memory board, same as AT Plus with 1 serial and 1 parallel port. Uses 1M x 1 DRAM chips.
including 2MB ..... $199 including 4MB $279

30 day Money Back Guarantee

Buy with confidence!

First Source International

"The Only Source for Computer Upgrades"

- 30 Day Money Back Guarantee
- 100% compatible in form, fit, and function
- All products user installable
- Installation instructions included
- Toll-free technical support
- Thousands of items in stock
- Manufacturer's warranties
- Corporate PO's, APO/FPO's welcome
- Government & Educational pricing
- International orders welcome
- Special volume pricing
- 24-hour fax line

FEDERAL EXPRESS

- Same day shipping
- Overnight delivery available

VISA

- Visa, MC, AMEX, and Discover accepted
- No surcharge on credit cards
- Call for any items not listed
- We'll meet or beat any advertised price

Toll free from anywhere in the United States or Canada

800/468-9866

International

714/588-9866

Facsimile

714/588-9872

Business Hours

Monday-Friday, 8am-5pm
Saturday, 8am-2pm, P.S.T.

OPEN SATURDAY

The Only Source for Computer Upgrades

First SOURCE International

Mail orders to:

First Source International, Inc.
36 Argonaut, Suite 140
Aliso Viejo, California 92656 USA

Terms and Conditions: Memory products are third party, manufacturer's numbers are for your convenience. First Source International will refund 100% of the sales price of the product if returned within 30 days of the invoice date. Freight charges are non-refundable. A Return Merchandise Authorization (RMA) number is required for all returns. Items must be returned within 30 days of the invoice date with original documentation and packaging. All non-defective returns, unopened, refused, or cancelled orders, and items returned after 30 days of the invoice date will be subject to a 20% restocking fee. Prices and availability are subject to change without notice. Purchase prices at the time of order are final. First Source International cannot be responsible for errors in typography or photography. We will beat any advertised price valid only on identical brands, offer not good for vendor or dealer. Trademarks and registered trademarks are of their respective companies.

CALL THE UPGRADE EXPERTS TOLL FREE 800/468-9866

WE ACCEPT PO'S FROM QUALIFIED FIRMS

M E M O R Y

NO SURCHARGE FOR MC, VISA & DISCOVER

★★ CALL TOLL-FREE 800-433-3726 ★★

★★ CO-PROCESSOR SALE ★★

INTEL 80387, 16SX or 16DX:	**59.00 each**
INTEL 80287XL, *Does* 6, 8, 10, 12 MHz:	**74.00**
INTEL 80287DX *Does* 16, 20, 25, 33 MHz:	**89.00**
INTEL 80387SL *for* SL Based NTBKS:	**89.00**
CYRIX 83D87-40MHz *for* 40 MHz:	**109.00**

HP LASER 4 MEMORY

2Meg — **80.00** 4Meg — **149.00**

8Meg — **309.00**

"We buy large volume of excess inventory."

Individual D-RAM Chips

MEMORY FOR IBM & APPLE

	60NS	70NS	80NS	100NS
1Meg x 1	4 75	4 50	4 25	—
1Meg x 4	24 00	20 00	18 00	—
1Meg x 4 (Zip Pack)	25 00	21 00	19 00	—
256 x 4 (Video Zip)	—	—	15 95	12 95
256 x 4	4 75	4 50	—	—
256 x 1	3 00	2 60	2 20	2 00
64 x 4	—	—	3 00	—
64 x 1	—	—	—	1 50

INTEL Math Chips

8087	49 00
8087-2	69 00
8087-1	89 00
80287-XL	74 00
80387-16 DX	59 00
80387-20 DX	65 00
80387-DX *(Does All)*	89 00
Intel SX *(Does All)*	89 00
Intel SL Mobil	89 00
Intel 16SX	59 00

SIMM MODULES (Add $5** for SIPP)

	40NS	53NS	60NS	70NS	80NS	100NS
1Meg x 9	69 00	54 00	38 00	37 00	36 00	34 00
4Meg x 9	—	—	164 00	139 00	134 00	—
16Meg x 9	—	—	—	749 00	—	—
256 x 9	—	—	20 00	19 00	18 00	17 00
256 x 36 1Meg (72 PIN)	EISA	—	—	—	50 00	—
512 x 36 2Meg (72 PIN)	EISA	—	—	85 00	80 00	—
1 x 36 4Meg (72 PIN)	EISA	—	169 00	159 00	149 00	—
2 x 36 8Meg (72 PIN)	EISA	—	309 00	299 00	299 00	—
4 x 36 16Meg (72 PIN)	EISA	—	619 00	609 00	599 00	—
8 x 36 32Meg (72 PIN)	EISA	—	—	1475 00	1450 00	—

CYRIX FASMATH PROCESSOR

Programs executed up to 3X faster • Plug & object code compat. w/Intel

PC Week • rated #1 over all math chips — 83087-40MHz — 109 00

5 Year Warranty — 83087-33MHz — 84 00

"All Downward Compatible" — 83S87-25SX Ver — 79 00

AST MEMORY MODULES

MODEL#	AMT. UPGRADED	AST PART#		PRICE
Advantage 12-386	4Meg Kit	500510-004		Call
Bravo 486/25, 33	2Meg Kit	500780-005		120 00
	8Meg Kit	500780-001		298 00
Bravo 486	2Meg Kit	500987-001		99 00
	4Meg	500987-002		159 00
	8Meg Kit	500987-003		318 00
	16Meg	500987-004		599 00
	32Meg Kit	500987-005		1200 00
Premium 386/25, 16 SX	1Meg	500718-001		55 00
Premium 386/33	1Meg	500718-002		56 00
Premium II	1Meg	500780-003	WP8	60 00
386SX20, 486-25, 25E, 33	4Meg	500780-004	WP8	149 00
Premium Tower, 386/33TE, 486/25TE, 486/33TE	8Meg	500780-001	WP8	298 00

ZENITH MEMORY UPGRADES

MODEL#	AMT. UPGRADED	ZENITH PART#	PRICE
Z386/33, 25, 20, 33E	1Meg	ZA3800ME	50 00
Z386/33, 25, 20, 33E	4Meg	ZA3800MK	149 00
Z248, Z286LP Z386SX	2Meg	Z-605-1 *modules*	99 00

MAGNAVOX

286/386SX-16, 386SX-20, 486SX-20 & 386-33

all are 72PIN SIMM

1MEG — 50 00

4MEG — 149 00 8MEG — 289 00

DELL

420, 425, 433, 450, DE, SE, TE

2/4Meg Kit — 129 00/199 00

8/16 Meg — 319 00/619 00

32 Meg — 1399 00

Call on other Dell Machines

IBM PS/2 SIMM MODULES

IBM PART NO.	WORKS WITH MODEL NO.	PRICE
30F5348 (512K)	30-286	30 00
30F5360 (2Meg)	30-286, 25-286, 50 MTHR BD	85 00
6450375 (1Meg)	80-041	79 00
6450379 (2Meg)	80-111, 311-121, 321, 081, 161	89 00
6451060 (4Meg)	80-A21, A-61, 80-A31, 80-111, 80-311	189 00
6450603 (1Meg)	35SX, 40SX, 55SX, Model-70's, P-70	54 00
6450604 (2Meg)	70-061, E61, 121, 50Z, 55SX, 65SX, P-70 55LS, 65LS, X-Station 120 & 130, 35SX, 35LS, 40SX	77 00
6450608 (2Meg)	70-A21, A-61, B-21, B-61, 35SX, 35LS, 40SX Value Point 325T	84 00
78X8955 (128K)	25	35 00
34F2933 (4Meg)	35SX, 40SX, 55SX, 65SX, 55LS, 65LS	149 00
87F9977 (4Meg)	55SX, 55LS, 65SX, 40SX, 35SX, 35LS	149 00
1057035 (512K)	P/S1	40 00
92F9935 (2Meg)	P/S1 & P/S1/386SX-2121	84 00
92F9694 (4Meg)	P/S1 & P/S1/366SX, Model-2121	149 00
6450902 (2Meg)	56, 57, 57SX 90, 95, P-75, 57SLC Value Point 77 486DX2, 486SX, SVR 85	89 00
6450128 (4Meg)	57SX, 90, 95, P-75, 57SLC, 56, 56SLC **P/S1, 386SX, Models-2123, 2133, 2155** Value Point 77 486DX2, 486SX, SVR 85	149 00
6450129 (8Meg)	35SX, 40SX	299 00
6450130 (8Meg)	56, 57, 57SX, 90, 95, P-75, 57SLC Value Point 77 486DX2, 486SX, SVR 85	299 00
79F0999 (2Meg)	LX40, N33SX, PS Note	99 00
79F1000 (4Meg)	LX40, N33SX, PS Note	159 00
79F1001 (8Meg)	LX40, N33SX, PS Note	299 00
07G1826 (2Meg)/07G1827 (4Meg)	N51 (all)	99 00/169 00
07G1828 (8Meg)	N51 (all)	309 00
07G1419 (2Meg)	CL57LSX Color LpTp, Thinkpad 700, 700C	169 00
07G1420 (4Meg)	CL57LSX Color LpTp, Thinkpad 700, 700C	219 00
07G1421 (8Meg)	CL57LSX Color LpTp, Thinkpad 700, 700C	359 00
92F8804 (2Meg)	N45SL	99 00

COMPAQ MEMORY MODULES

MODEL#	AMT. UPGRADED	CMPQ PART#	PRICE
DeskPro 386/33, 386/33L, 486/25, 486/33L, 486/50L, System Pro	2Meg Module	115144-001	99 00
	8Meg Module	116561-001	289 00
	32Meg Module	116568-001	1500 00
DeskPro 386/33L, 486/33L	(Exp Bd)	116569-001	319 00
DeskPro 386/25, 386/20	1Meg Module	113131-001	79 00
	4Meg Module	113132-001	179 00
DeskPro 386S-16MHz	1Meg Exp Bd	113633-001	110 00
	4Meg Exp Bd	113634-001	219 00
	1Meg/4Meg Module	113646-001/112534-001	75 00/179 00
DeskPro 386/20E	1Meg Exp Bd	113644-001	119 00
DeskPro 386/25E	4Meg Exp Bd	113645-001	219 00
	1Meg/4Meg Module	113131-001/113132-001	75 00/179 00
DeskPro 286N, 386N, 386SX/20, 386/25M, 486/33M, 486S/25M, 486S/16M	1Meg Module	118688-001	50 00
	2Meg Module	118689-001	85 00
	4Meg Module	118690-001	159 00
M Series Exp Bd	0-64Meg	—	299 00
Port 486C	8Meg Module	128877-001	319 00
DeskPro 386/16	1Meg Kit	108071-001	99 00
	4Meg Kit	108072-001	269 00
	1-2Meg/4-8Meg Exp Bd	108069-001/108070-001	239 00/399 00
DeskPro 286	512K Kit	113012-001	59 00
Prolinea 4/33	1Meg/2Meg	141682-001/141683-001	55 00/98 00
	4Meg/8Meg	141684-001/141685-001	159 00/319 00

COMPAQ PORTABLES & LAPTOPS

Compaq SLT/286	1Meg Module	110235-001	79 00
	4Meg Module	110237-001	219 00
Compaq SLT/386	1Meg Module	118303-001	79 00
	2Meg Module/4Meg Module	118304-001/118305-001	109 00/179 00
Compaq Lte 286	1Meg Bd	117081-001	79 00
	2Meg Bd/4Meg Bd	117081-002/117081-003	99 00/219 00
Compaq Lte 386S/20	4Meg Module	121125-002	179 00
Compaq Lte Lite/20, 25	4Meg Module	129769-002	179 00
Compaq Lte Lite/20, 25	8Meg Module	129769-003	359 00
Compaq Lte Lite/20, 25	16Meg Module	N/A	Call
Compaq Contura 386SL, 320, 325	2Meg/4Meg	139497-001/139498-001	99 00/169 00
	8Meg/16Meg	139499-001/N/A	319 00/759 00

HEWLETT PACKARD

Apollo 9000/345, 375, 380 • 9000/4000L, 400S, 400T • 9000/425T, 433T

4Meg Kit H-982298 — 299 00 8Meg Kit H-98229C — 499 00

16Meg Kit H-982290 — 899 00 32Meg Kit H-98229E — 1699 00

Vectra 486S/20PC, 486/25T • 486/33T, 486PC

1Meg D2150A — 59 00 4Meg D2151A — 159 00

Vectra 386/25PC, 486S/20PC, 486/PC, 486/25T, 33

2Meg D2381A — 99 00 8Meg D2152A — 329 00

NEC POWERMATE

386/25S — 2Meg Kit/8Meg Kit—199 00/619 00

386/33E, 486/25E — 2Meg—169 00

386/33I Express Te & E — 1Meg/4Meg/16Meg — 69 00/149 00/649 00

TOSHIBA LAPTOP MEMORY

LAPTOP MODEL #	AMT. UPGRADED	TOSHIBA PART #	PRICE
T1000SE/XE/LE	2Meg	PC14-PA8312U	75 00
T2000/T2000SX	2Meg	PC18-PA8317U	75 00
T2000SX/T1000LE	4Meg	PC-PA8314U	149 00
T2000SX/T1000LE	8Meg	PC14-PA8315U	269 00
T2000SXE/2200SX/T1800 1850 C	2Meg	PC PA2000U	75 00
T2000SXE/2200SX/T1800 1850 C	4Meg	PC PA2001U	149 00
T2000SXE/2200SX/T1800 1850 C	8Meg	PC PA2002U	269 00
T4400SX SXC T6400	2Meg	PC PA2003U	129 00
T4400SX SXC T6400	4Meg	PC-PA2004U	169 00
T4400SX SXC T6400	8Meg	PC PA2005U	299 00
T4400SX SXC T6400	16Meg	PC-PA2010U	599 00
T4400SX SXC, T6400	32Meg	N/A	2999 00
T3300SL	2Meg	PC PA2006U	99 00
T3300SL	4Meg	PC-PA2007U	169 00
T3300SL	6Meg	PC PA2008U	229 00
T3300SL	8Meg	N/A	369 00
T3300SL	16Meg	PC-PA2009U	799 00
T1200XE	2Meg	PC13-PA8306	85 00
T1600	2Meg	PC8 PA8302U	85 00
T3100	2Meg	PC3-PA7135E	179 00
T3100e	2Meg	PC9-PA8340U	85 00
T3100SX	2Meg	PC15-PA8308U	85 00
T3100SX	4Meg	PC15 PA8310U	164 00
T3200	3Meg	PC6-PA7137U	164 00
T3200SX	2Meg	PC12-PA8307U	85 00
T3200SX	4Meg	PC12-PA8909	164 00
T3200SXC	2Meg	PC19-PA8318U	84 00
T3200SXC	4Meg	PC19-PA8319U	164 00
T5100	2Meg	PC7 PA8301U	89 00
T5200/T8500	2Meg	PC10-PA8304U	94 00
T5200/T8500	8Meg	PC10-PA8313U	299 00

NOTEBOOK, LAPTOP MEMORY

Leading Edge D/LT 386SX	1Meg		109 00
Bondwell B310, Plus	1Meg	23050-09100	109 00
Bondwell B310V, SX	1Meg		109 00
Bondwell B310V, SX	4Meg		299 00
NEC Prospeed 286, 386SX-16	1Meg	PC21-21	105 00
NEC Prospeed 286, 386SX-16	4Meg	PC21-22	179 00
NEC Prospeed 386	2Meg	PC31 21	129 00
NEC Prospeed 386	8Meg	PC31-22	419 00
NEC Prospeed 386SX-20	1Meg	PC43-21	109 00
NEC Prospeed 386SX-20	4Meg	PC43-22	219 00
NEC Prospeed 486SX, SX/L	1Meg/4Meg	OP-410-6204/6205	Call/Call
Sharp PC-6220	1Meg	CE 621B	85 00
TI Travelmate 2000	1Meg	2568034-0001	85 00
TI Travelmate 3000	2Meg	2566996-1	79 00
TI 4000	4Meg, 16Meg		199 00, Call
Zeos 386SX Notebook	2Meg		89 00
Zenith Master Sport 386SX	2Meg	ZA-300-1	119 00
Zenith Master Sport SL, SLE	2Meg	ZA-4-4	99 00
Zenith Super Sport —			
286, 286E	1Meg	ZA-180-66	89 00
286E, SX	2Meg	ZA-180-64	119 00
SX Alpha	2Meg	ZA-180-86	119 00
SX Beta	2Meg	ZA-180-87	119 00
Zenith Z-Note 325	2Meg/8Meg	ZA3250-4/-5	139 00/599 00
Everex Tempo LX, LX20	2Meg	PCA 00053-0001	89 00
Everex Tempo Carrier	2Meg	PWA 0884-A-J000	119 00
AST Notebook Prem Exec	4Meg	500814-003, 386SX/20/25/25L	139 00
Sanyo 17/18 NB	2Meg	M8C-NBMEM2	89 00
Panasonic CF170, CF270, CF370	1Meg	CF-BA165	54 00
Epson NB3	4Meg	A808511	179 00
Epson NB/SL 20 25,25C	2Meg/4Meg/8Meg		129 00/219 00/479 00
Tandon, PC Brand, Dataworld	2Meg, 8Meg	NB386SX 20	89 00 319 00
AT&T Safari NSX/20	2Meg, 4Meg	PEC37650 37651	119 00 239 00
Packard Bell 386SX, 286	1Meg, 4Meg	286, 386SX	89 00, 199 00
Magnavox Metalis	1Meg, 4Meg	286, 386SX	89 00, 199 00
Goldstar GS520 386SX/16	1Meg, 4Meg	S386-1M S386-4M	99 00, 249 00
Dell 212, 320N, 320N+	2Meg	310-3204	119 00
Dell 325N, 325NC	2Meg	310-3210	119 00
PCMCIA Cards:	**1Meg, 2Meg**		**179.00, 319.00**

H.P. 95LX Palmtop, Dell 320 SLi, Sharp, NCR, Fujitsu

LASER PRINTER MEMORY UPGRADES

	1MEG	2MEG	4MEG		1MEG	2MEG	4MEG
HP 2,2D,3,3D,3P,2P+	—	104	[illegible]	Canon LBP4	129	179	—
HP 4	Call	80	149	IBM Laser 4029	—	—	139
(8 MEG — 309.00)				HP III SI	55	—	139
Panasonic 4410/4430	—	119	189	Panasonic 4455	—	119	—
Panasonic 4420/4450I	89	119	189	NEC 90, 290	—	119	—
Panasonic 4450	105	—	—	NEC 95	—	99	—
Epson 6000, Action Lsr	—	115	179	QMS 410	119	159	249
Epson Action Laser II	Call	Call	Call	TI XL/PS17/PS35	49	—	—
Toshiba Page Laser 6	—	115	179	STAR LS04	129	179	269
Packard Bell P89500	—	115	179	Starscript 4	129	179	269
Oki 400	—	99	—	DeskJet 500, 500C (256K)			64 00
IBM Laser 4019, 4019E	—	—	139				

H.P. COMPATIBLE FONT CARTRIDGE

DESKJET SOLUTION for DkJt 500 & Plus, 92 Fonts, 4 5 pt-30 pt	105 00
IBM 4019, 4019E, FONT CARTRIDGE 209 Fonts, Turbo Card	105 00
TURBO 25 Comparable to Pacific Data's 25 CARTRIDGES IN ONE!™, 150 Fonts (works with Epson Action Laser II)	79 00
TURBOSCRIPT™ 47 Scalable Fonts in Any Point Size	179 00
TURBOSCRIPT™ 109, 109 Scalable Fonts to Any Point Size	239 00
TAX & FINANCE FOR IBM 4019, 4019E, 4029	139 00
TAX & FINANCE CARTRIDGE	84 00
OKI 400, 800 41 fonts, 11 typestyles	169 00

BOCA AT PLUS (DIP SIMM)

16 BIT MEMORY BD. FOR 286, 386 AT • 0K-8Meg Bd. • 4.0 LIM Compat. • New 5 Yr. Warr. • Convent., Expnd. & Extnd. Memory • Supports DOS, OS/2, LIM/EMS & EEMS • Versatile Split Memory Addressing • Operates w/CPU Speeds to 33 MHz • Supports Desqview, Multitask operations

0K — $99.00 2Meg — $169.00 4Meg — $249.00 8Meg — $379.00

Board made by Boca Research, AT plus

BOCA XT 8 BIT BUS

• Expanded memory for XT • Lim 4.0 compat. 0-2Meg • Uses 256x1-100

O-K . $99 00 1Meg $179 00 2Meg $219 00

IBM P/S2 32BIT EXPANSION BD.

0-32Meg, Ext -Expnd. Memory Bd for P/S2 70, 80, 90, Lim 4.0

0Meg	2Meg	4Meg	8Meg	16Meg	32Meg
$179 00	$258 00	$328 00	$477 00	$799 00	$1,499 00

MEMORY BOARDS

IBM Compatibles & PS/2

★ **WE WILL TRY TO MATCH OR BEAT ANY ADVERTISED PRICE** ★

All products Brand New & Guaranteed • We Buy Excess Inventory

Trademarks are registered with their respective companies

L.A. TRADE

WE'VE MOVED NEW ADDRESS:

22825 Lockness Avenue • Torrance, CA 90501

PS/2 MCA 0-8MEG EXPANSION BD.

USES 1 TO 8 SIMMS (BOCA MC-8)

0-8Meg Extended and/or Expanded Memory for all IBM P/S2 Models 50, 50Z, 60, 55SX, 65SX, 16 Bit, 4.0 LIM Compat.

0K — 119.00 • 2Meg — 190.00 • 4Meg — 265.00 • 8Meg — 410.00

NO SURCHARGE FOR MASTERCARD, VISA OR DISCOVER. PURCHASE ORDERS ACCEPTED FROM FORTUNE 2000, GOVERNMENT & INSTITUTIONS. Price & availability subject to change. California orders add 8.25% sales tax. Returned orders or ordered wrong parts are subject to a 20% restocking fee (Memory chips not installed in boards.) We accept international orders shipped via UPS Air, APO, FPO orders welcome. Customers are expected to pay customs and "other" charges if shipped Int'l. **All credit card charges verified for fraudulent use. SORRY, NO REFUNDS AFTER 30 DAYS — EXCHANGES ONLY.** We accept MC, VISA, Discover, AE, prepaid orders, purchase orders, wire transfer, COD (cashiers check) orders, cash & cashiers checks. Orders shipped by UPS, FEDX must be signed for • ALL MANUFACTURER PART # S ARE FOR REFERENCE ONLY

310-539-0019
FAX: 310-539-5844

WE'VE MOVED!!!

CALL TOLL FREE

1-800-433-3726
(US and Canada)

ESTAB. 1985

Mon-Fri, 8:00 a.m. to 5:00 p.m. PST
Sat. 10:00 a.m. to 12:00 noon

CIRCLE 019 ON READER SERVICE CARD

PACIFIC WAVE TECHNOLOGY

SPECIALIZING IN INTERNATIONAL ORDERS

COMPUTERS

IBM PS/2	
PS/2 Mod 30 EOI	250
PS/2 Mod 65 120 Mb	650
PS/2 Mod 70 A21	1300
PS/2 Mod 90/95-486	Call
PS/2 700 C 120 Mb	4100
IBM PS VALUE (w/Mouse & Dos)	
386 SLC 25 0/80/170 Mb	835/979/1160
486 SX 25 0/80/170 Mb	1018/1240/1440
486 DX 33 0/120/210 Mb	1385/1598/1789
COMPAQ	
486 DX2 66 212 Mb	2895
Contura 3/25 60/120	1500/1900
Prolinea 120/240/W/50 Mhz	Call
LTE SL/25 60/80/120	2460/2640/2995
LTE Color 80/120 Mb	Call/3795
DPro 486/50 M	Call
DPro 486 66 M/1	Call
DPro 486/33 M (All Models)	Call
TEXAS INSTRUMENTS	
Travelmate 3000 60/80/120	1595/1767/1925
Travelmate 3000 Win SX 60/80/120	1699/1850/2049
Travelmate TM 4000 SX/25 120 Mb	2395
Travelmate TM 4000 DX/25 120/200 Mb	2795/3049
Travelmate TM 4000 DX/50 200 Mb	3314
AST	
Bravo 486 DX/33 MDL 3V	1350
Bravo 486 DX 2/66	1979
Power Premium 486 DX 33 MDL 3V	1977
Power Premium 486-50 D MDL 3V	2130
Power Exec 386/25 SL 60/120	2150/2499
Power Exec 386/25 SL Color	Call
TOSHIBA	
T1800 60 Mb	1299
T1850 LCD 80/120/Color	1860/2075/2380
T3300 SL 80/120	1975/2140
T4400 SX-80 LCD/PDP	2250/2325
T4400 SX-120 LCD/PDP	2450/2550
T4400 C/200 Mb DX	3395/4100
T6400 SX/SXC	3499/5750
T6400 DX/DXC	4200/6450

MONITORS & TERMINALS

MONO/COLOR	
IBM 8504	250
Samsung 14" VGA Mono	129
Samsung Amber 12" TTL	85
VGA/SVGA MONITORS	
IBM 8515/8518/8513	560/499/250
IBM 6312/6314/6319	415/510/630
IBM 9515/17/18	620/1209/512
MAG 15"/17F	595/1089
Samsung Syncmaster 4 17"	775
NEC 3FGX/4FG	619/739
NEC 5FG/6FG	1269/2360
Packard Bell VGA 8539/29/28	230/270/359
Panasonic 1381/95/1991	339/479/1599
Sony CPD 1304/1604S	599/1019
Zenith 1492	595

VIDEO BOARDS

ATI Ultra Plus 1 Mb/2 Mb	295/339
ATI Ultra Pro 1 Mb/2 Mb	426/499
ATI Ultra Pro 2 Mb EISA/MCA	599
ATI Wonder XL 24 512/1 Mb	132/149
Diamond Stealth VRam	255
Diamond Speedstar 24/24k	149/159
Mono/w Parallel Card	45

PRINTERS

CANON			
BJ 10 EX/BJ20			249/399
BJ 20			399
BJ 200/300/330			345/339/599
BJC 600			1899
CITIZEN			
GSX 230/240+/145			259/339/399
PN 48 Professional			339
EPSON - *220V Available*			
Action Printer 2250/3250			135/195
FX 870	288	LQ 1070	368
FX 1050	359	LQ 1170	549
FX 1170	383	LQ 2550	849
LQ 570	254	EPL 8000	1089
LQ 870	454		
HEWLETT-PACKARD - *220V Available*			
LaserJet 4/4M			1399/1975
LaserJet 3D/4D			2349/Call
LaserJet 3Si			3300
LaserJet 2P+/3P			819/950
Toner & Cable included with all lasers			
DeskJet 500/550C			399/699
DeskJet Portable			399
ScanJet II P			840
ScanJet IIC Color Scanner			1415
PaintJet XL 300			2279
HP Options			Call
FONTS & MEMORY			
Pacific Data 25-1 III/DeskJet			259/109
Pacific Data 1/2/4 Mb			89/120/175
Pacific Page PE/XL			289/671
Pacific Data Plotter in a Ctg			239
Compaq 1/4 Mb Modules			118/275
IBM/TI/Toshiba/AST			Call
CPI Superset 425+			219
CPI DeskRam 256k DJ500			89
CPI 66 Font DJ500			109
IBM (IBM & MAC)			
Exec Jet			669
Laser Printer 10P/10A			2034/1818
Laser Printer Options			Call
IBM 2390/2391/4226			346/460/400
IBM 4070 InkJet			340
IBM ColorJet			2600
NEC			
Silent Writer 990			2499
Silent Writer 2 Mod 95			1399
Silent Writer 2 Mod 97			Call
OKIDATA (IBM & MAC) *220V Available*			
ML 184			215
ML 320/321			324/435
ML 590/591			439/585
ML 393+/393+color			919/999
OkiLaser 400/810			590/1075
OkiLaser 820/830/840			1276/1325/1549
PANASONIC			
1123/1180 L			214/160
1124/1624			291/349
1654/1695/2624			528/364/379
2123/2124			244/329
2180			181
4410/4430/4450/4455 Laser			649/899/1099/1750
TEXAS INSTRUMENTS			
PS 17 Laser			1198
PS 35 Laser			1316
Microlaser Turbo			1563

TERMINALS

Wyse 50/60	375/300
Wyse 30/85	310/339
Wyse 150/185	289/379

SOFTWARE

All Mac Titles Available	Call
Aldus Pagemaker 4.0	495
Ashton Tate dBase III+/IV	419/479
Borland Quattro Pro 4.0	299
Carbon Copy 6 0	133
Compaq/IBM DOS 5.0	89/125
Harvard Graphics 3 0/Wind	370/325
Laplink Pro	103
Lotus 1-2-3 2 4/3 1	329/399
Lotus Windows 1 1	299
Microsoft	All Titles-Lowest Price
Microsoft DOS Upgrade	53
Microsoft Excel 4 0	295
Microsoft Office-Windows	455
Microsoft Windows 3 1	89
Microsoft Word-Windows	289
Microsoft Works-Windows 2 0	123
Norton Util 6 1	114
Procomm Plus V2	63
Quattro Pro	304
Quicken 6 0	38
Stacker 3 0	88
Ventura Publisher V 3 0	479
WordPerfect 5 2/Windows	260
1200 Additional Titles In Stock	

PLOTTERS & DIGITIZERS

HEWLETT-PACKARD	
7475A/7550B	1349/2699
7570A/7575A	2999/3350
7576 EXL	4150
SUMMAGRAPHICS	
Summasketch 2+ 12X12/12X18	289/515
CALCOMP	
Pacesetter 2024/2036	2899/3700
Digitzer 12X12/12X18	298/597

MULTIFUNCTION BOARDS CARDS & CHIPS

IBM 5250 Emulation	533
IBM 3278, 3279 Emulation	Call
Token Ring 16/4	625
AST 5251 Emulation	499
AST 6-Pack w/384 k	145
Intel AboveBoard Plus w/512 k	289
Intel 80387-SX	77
Intel 80387-DX	85
Cynx Fasmath	Call

MODEMS & COMMUNICATIONS

ATI 9600 ETC	266
Boca 14 4 Fax/Modem Int/Ext	219/275
CPI 2400 Internal	49
Everex 2400v/2400 MNP	99/164
Hayes 2400/2400B	289/218
Hayes Ultra 96	569
Hayes Ultra 144	760
Practical Pocket Modem	99
Practical 14 4 Int/Ext	350/380
Intel 14 4 Ext	444
MegaHertz Laptop Modems	Call
Supra 14.4 w/Fax Int/Ext	219/299
US Robotics Cour HST	485/515
US Robotics Dual Std	760/779

FAX MACHINES

Hewlett Packard Plain Paper 200/310	999/1299
Hewlett Packard Laser Fax	920
Intel Satisfaction 100/200	115/293
Intel Satisfaction 400/400E	389/437
US Robotics World Port 2496	259
Megahertz Pocket 2400 S/R Fax	249
Megahertz Pocket 96/96 SR	479

MICE

Logitech Mouseman	72
Logitech Scanman 32/256	139/260
Microsoft Mice/+Windows 3.1	92/144
Microsoft Ballpoint/Windows 3.1	115/144

DRIVES TAPES

Colorado DJ10/20	169/199
Colorado Tracker Parallel 120/250	345/414
Conner 40/80	185/215
Conner 120/210/360/540	269/399/819/909
Creative Labs Multimedia Upg. Kit Int/Ext	546/606
Plus II XL50/105	228/375
Irwin All Models	Call
Mountain All Models	Call
NEC CDR 74/84 MPC	609/542
Panasonic LF 7010 1 Gb Erasable Optical Drive	2740
Parallel Port Ext Floppy	175
Procom PS2 Hard Drive 120/200 Mb	Call
Sysgen Mobile Disk 40/80/124 Mb	319/419/527
Sysgen 21 Mb Floptical Drive Kit	335

NETWORK

ARTISOFT	
Lantastic 2 Mb Starter Kit	338
Lantastic 2 Mb Adapter	139
Lantastic 10 Mb Starter Kit	469
Lantastic AE3 Starter Kit	539
Lantastic 10 Mb Adapter	199
NETWARE	
Netware 2 2 5-User	489
Netware 2 2 10-User	1162
Netware 3 11 5-User	629
Netware 3.11 10/20-User	1350/1795
Netware 3.11 100/250 User	3699/6795
NE 1000/NE 2000	149/162
NE/2 /NE 3200 (EISA)	249/687
SMC	
Arcnet PC 130 8 Bit	99
Arcnet PC 600 fs 16 Bit	220
Arcnet PC 600 ws 16 Bit	139
Ethercard Plus Elite 16	155

MISC. & ACCESSORIES

Keytronics KB101+	90
Kensington Masterpeace/Plus	85/95
AB Switch Box	27
Tripp Lite - All Models	Call
American Power Conversion - All Models	Call

Call for our 12,000 item Electronic Price Cataogue

1 (800) 348-4727

1 (800) 348-4727

0031-11-1865

通訳サービス

0014-800-126-943

0130-816218

Dolmetscher

0800-89-4935

For all other countries, dial 80 887 51 100

In Hawaii (808) 875-1100
Shipping & Tech
1 (808) 875-1108
FAX (808) 875-0061
HOURS: 8:30 am - 8:30 pm CST
MON - FRI. 10 am - 4 pm CST, SAT.
PACIFIC WAVE TECHNOLOGY
P.O. BOX 848312
DALLAS, TX 75284-8312

Most orders shipped within 48 hours / 24-hour worldwide order tracking / Printer orders received by 9 PM CST can be shipped same day All credit card and COD orders checked electronically We accept Amex Visa MC JCB Discover Diners Club Carte Blanche, COD's, Wire Transfer **TERMS & LEASE AVAILABLE** (one day approval) Credit cards not charged until product shipped **GOVERNMENT AND EDUCATIONAL P.O.'S ARE WELCOME** Allow 10 days for personal checks to clear Prices reflect a 3 percent cash discount Non-defective returns subject to a restocking charge All warranties good through Pacific Wave Technology / Prices subject to change without notice / All freight charges to be incurred by purchaser for refused COD shipments / Please allow 24 hours on large credit card orders

CIRCLE 145 ON READER SERVICE CARD

If you replace PC Magazine, will

No other publication speaks with the authority of
reaches so many in all your target markets. Over 900,000 brand
and resellers–will attest to the fact that when it comes

© 1992 Ziff-Davis Publishing Co.

you command the same audience?

PC Magazine. And no combination of publications
specifiers–department heads, MIS managers, LAN specialists
to capturing their loyalty, one publication is a true leader.

PC MAGAZINE
Nothing comes close.

PC MAGAZINE MARKETPLACE INDEX

Premier
The color showcase that puts the spotlight on leading-edge PC products and services.

418-425

Windows
An every-issue four color section featuring quality products for the Windows environment.

426-427

Classified
Flexible-format display advertising: computer systems, components, software and more.

428-435

BusinessCard
A forum for innovative, hard-to-find and low cost PC hardware, software and services.

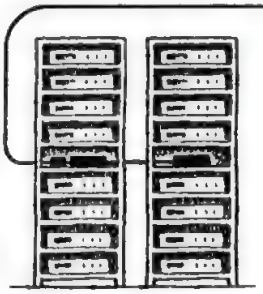
436-442

	Premier	Classified
HARDWARE		
Boards/Components/Chips	419	428
Communications		
Computer Systems		428
Input/Output Devices	420	429
—Barcoding		429
Mass Storage Devices	421	430
Midi		
Multi-Media		
Networking		
OS2		
Security		
Video	422	

	Premier	Classified
SOFTWARE		
Business Applications	422	430
Communications		431
Education		431
Financial		
Graphics/Design	423	431
Multi-Media	423	
—Midi-Music		
Personal		
Public Domain		
Scientific		
Security		431
Shareware		432
Systems/Languages		
Utilities	423	432
Vertical Applications		
Adult	424	434
Windows		

	Premier	Classified
SUPPORTING PRODUCTS		
Information Resources	425	
Services		432
Supplies		433

COMMANDER



Dealer Program Available
Made in USA

Control up to 96 file servers with one keyboard, monitor and mouse!

- Supports PC, PC/XT, PC/AT, PS/2 and 100% Compatibles
- Remotely switch PCs via keyboard up to 150 feet away
- "AutoBoot™" Feature boots attached computers without operator intervention
- Supports either PS/2 or Microsoft/Logitech serial mouse
- Each unit accommodates from 2 to 8 PCs; cascade up to 12 units.

CYBEX

2800-H Bob Wallace Ave.
Huntsville, AL 35805 USA
(205) 534-0011
Fax (205) 534-0010

IBM, PC, PC/XT, PC/AT and PS/2 are registered trademarks of International Business Machines Corporation
Microsoft and Logitech are registered trademarks of their respective companies.

CIRCLE 851 ON READER SERVICE CARD

Multi-Line Voice Mail Plus. . .

FAX ON DEMAND!

FAX ON DEMAND • VOICE MAIL
CALL PROCESSING • TELEMARKETING

VOICE PLUS gives you professional VOICE MAIL & AUTO TRANSFER while it pounds out Fax'd Hard Copy non-stop - 24 hours a day Give it to them - NOW! Complete Package with Hardware and FAX Software 2 year warranty Requires PC/AT/386/486.

VOICE PLUS.....only $695

Special attention given to developers and OEMs Low price Developer Starter Kits available

MULTI-LINE HARDWARE...from $299

For Sales and Information CALL . .

1-800-934-4884

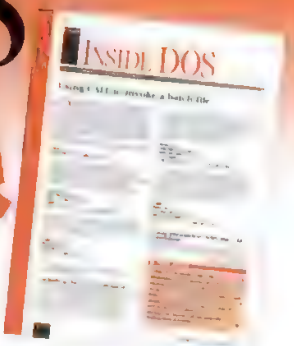
510-522-3800 • FAX 510-522-5556

TALKING TECHNOLOGY, INC.

1125 Atlantic Ave Alameda California 94501

CIRCLE 852 ON READER SERVICE CARD

DOS FREE TIPS!



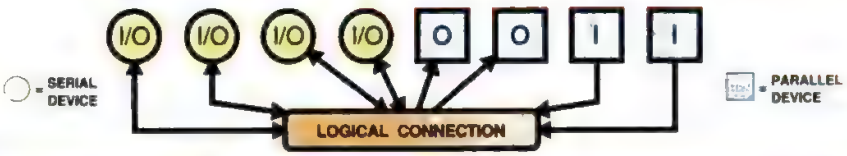
Inside DOS will show you how to use DOS more productively. You'll find timesaving shortcuts, proven methods, and step-by-step instructions in every information-packed issue. ◆ Subscribe today and we'll send you 13 issues for the price of 12 for only $39! If you decide *Inside DOS* is not for you, mark "cancel" on your invoice and return it. Your free bonus issue will be yours to keep with no further obligation. ◆ *Inside DOS* is guaranteed to help you get the most out of DOS. But don't take our word for it. See for yourself.

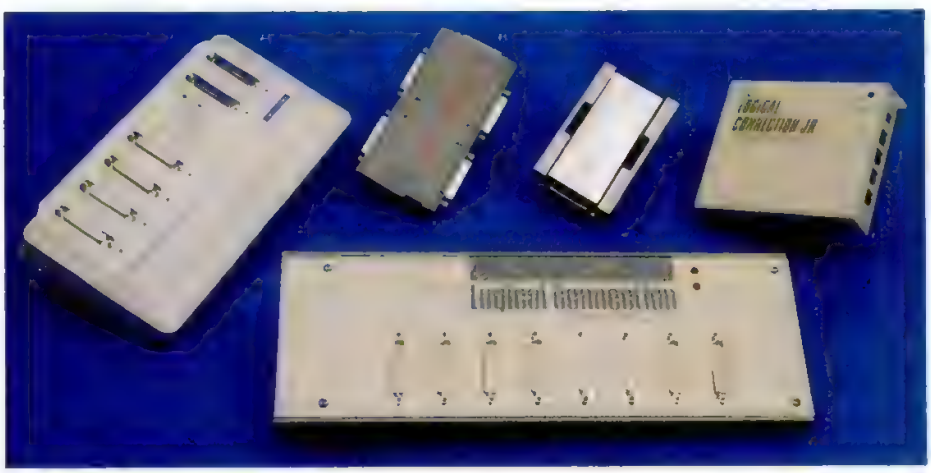
Call for your FREE ISSUE today!

1-800-933-8700

Please mention code V5NX

LOCAL PRINTER SHARING





LCX-1000 1Mb $595
4 serial I/O, 57,600 bps
2 parallel in, 2 parallel out

LC-512Kb $495
4 serial I/O, 19,200 bps
2 parallel in, 2 parallel out
Many New Features!

LC Jr.-256Kb $239
Up to 115,200 bps
4 serial in, 1 parallel out

LC-41PAS $90
Smart-switch
4 in / 1 out, all parallel
Requires no power supply

SPPS $60
Up to 115,200 bps
Serial / Parallel Converter
Requires no power supply

PB-42PP-256Kb $250
4 in / 2 out, all parallel
Upgradable to 4Mb

Logical Connection, Inc.
4660 Portland Road NE #108
Salem, OR 97305-1697

Customer Support:
(503) 390-9375
FAX: (503) 390-9372

800-238-9415

CIRCLE 853 ON READER SERVICE CARD

ONLY ONE THING COULD BE EASIER THAN OUR BAR CODE PRINTING SOFTWARE.

All StrandWare form and label generation software packages are easy to learn and easy to use. Like newly-upgraded Quick Draw, with mouse driven pull-down menus, and laser down-loadable bar codes for fast printing of Zip + 4 Postnet and most popular bar codes—all for just $259. Or try other StrandWare bar code printing software products, including Label Matrix, Power Label and Bar Code Library. Call **(800) 552-2331** or fax (715) 833-1995 to find out more.

The Computer Connection
StrandWare
For Anyone Who's Keeping Track.

© 1992 StrandWare Inc

CIRCLE 855 ON READER SERVICE CARD

MiniSCSI*plus*
High-Performance Parallel-to-SCSI Adapter

Transform Your Parallel Port

Connect up to 7 SCSI devices to your parallel port and still use your printer!

Up to twice as fast as our original **MiniSCSI**, the **MiniSCSI Plus** lets you run a CD-ROM, tape backup, SyQuest, Bernoulli or other SCSI device from almost any parallel port. For most notebook users, it's the only way to use SCSI devices. Plus, an integrated cable makes it a snap to share SCSI devices with desktops and other notebooks.

Call Today For Details!

800-872-6867 · 800-TRANTOR

TRANTOR

Trantor Systems, Ltd.
5415 Randall Place • Fremont, CA 94538-3151
TEL (510) 770-1400 • FAX (510) 770-9910

©1992 Trantor Systems Ltd. MiniSCSI and MiniSCSI Plus are trademarks and Trantor is a registered trademark of Trantor Systems Ltd. All other products names are trademarks or registered trademarks of their respective companies.

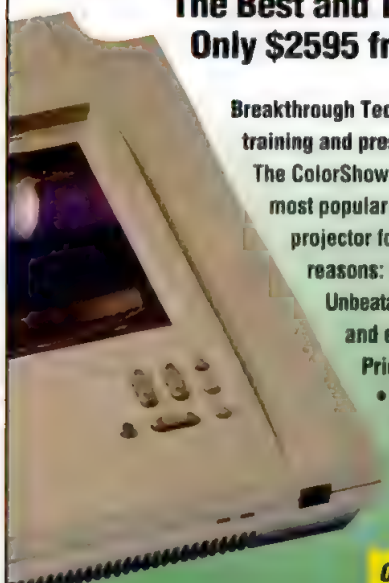
"This product... is darned near perfect"
–Jerry Pournelle Byte Magazine March 1993

"This year, the company outdid itself. The MiniSCSI Plus is even more elegant than its predecessor and almost twice as fast"
–Jim Seymour, PC Magazine December 1992

CIRCLE 857 ON READER SERVICE CARD

PC Screen to Big Screen!

The Best and The Brightest! Only $2595 from BOXLIGHT!



Breakthrough Technology for meetings, training and presentations.
The ColorShow is the industry's most popular color software projector for all the right reasons: Brilliant true color! Unbeatable reliability! Versatility and ease of use! Price! Price! Price!

- 640 x 480 resolution
- IBM and Mac compatible
- 1-year warranty
- Same-day shipping

BOXLIGHT CORPORATION

Order today... Use It Tomorrow! Just Call...
800-497-4008

America's Largest and most Experienced LCD Specialists

17771 Fjord Dr., N.E., Poulsbo, WA 98370 • 206/779-7901
Payment: Visa, MasterCard, American Express, COD and Purchase Orders (some restrictions)
Leasing and Rental Options Available, 30 Day Money-Back Guarantee

CIRCLE 856 ON READER SERVICE CARD

STAND-ALONE LCD MONITOR

New Touch Screen Option Available

$795 This 10" black on white monitor is easy-to-read, yet compact. Resolution is 640x480 for sharp, flicker-free image. Fast response, high refresh rate twisted nematic technology with backlighting provides a bright low radiation screen with a wide viewing angle. The adjustable monitor base is only 29x14 cm. It lets you mount the LCD monitor on vertical surfaces or fold for transport. Comes with 1.5 m cable and controller card. No external power required. IBM AT compatible.

$1,295 New Touch Screen Version. Capacitive technology from MicroTouch™. Provides high resolution, fast response, all glass scratch proof optically clear touch sensor. Complete with controller and software. DOS Windows compatible.

To Order Call Toll-Free: **1-800-DATALUX**

DATALUX

Tel: 1-703-662-1500
FAX: 1-703-662-1682
AutoFAXed Specs: 1-703-662-1675

155 Aviation Drive • Winchester, VA 22602

CIRCLE 858 ON READER SERVICE CARD

9 TRACK TAPE DRIVES
3480 TAPE DRIVES
FOR PC/XT/AT/386/486/PS2

LOWEST PRICES BEST QUALITY

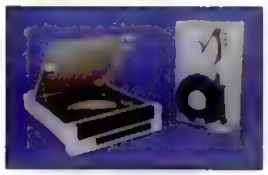
LAGUNA DATA SYSTEMS
23151 Alcalde Drive
Suite B-3
Laguna Hills, CA 92653
(800) 886-4827
714-586-3010 TEL.
714-586-5538 FAX

CIRCLE 859 ON READER SERVICE CARD

Largest Selection of Tape Products
PE 9-Track ◆ GCR 9-Track ◆ 3480 Cartridge
TK50/70/85 ◆ 4mm & 8mm ◆ 1/4 Cartridge
SALES, RENTALS, TECHNICAL SUPPORT, CONVERSIONS, SERVICE/REPAIRS
Call for Competitive Pricing!
1•800•362•6250
FAX: 301•330•9510
Gaithersburg, MD
INTERFACE SYSTEMS INC.

CIRCLE 862 ON READER SERVICE CARD

BEST 9-TRACK TAPE SOLUTION OF THE 90'S!



• PC 286/386/486
• RISC/6000 • AS/400
• SUN • HP • DEC • APPLE
Our name begins with Quality!
Call us today for price and information.

QUALSTAR®
9621 IRONDALE AVE., CHATSWORTH, CA 91311
FAX (818) 882-4081 • (818) 882-5822

CIRCLE 860 ON READER SERVICE CARD

New Products Expand
NOW all of the PCTD-1 features that earned PC Magazine recognition as "Editors' Choice" and "the clear winner among nine-track back-up devices" are available with a complete line of NineTrack 3480 3490 SCSI Controller Kit and tape subsystem solutions. Like the PCTD line, the new SCSI line reads writes to 9-track and 3480/3490 tape with your IBM* PC/XT*/AT* 386 486, PS/2* and compatibles. Exchange data with other PCs, minis and mainframes using a variety of tape densities.

3480/3490 & NineTrack system features:
• Auto & cartridge load systems available
• Data transfer rate up to 43 56 MB/minute
• Interchange & backup software
• ReelView data extraction & conversion software
• 800 1600 3200 6250 bpi & 3480 3490 systems available
• Toll-free direct access to dedicated product line technical support

COMPUTER LOGICS

CIRCLE 863 ON READER SERVICE CARD

NEW! WORLD'S SMALLEST PORTABLE DATA STORAGE New Low Prices
Battery, PS, Charger, & Parallel port inside.
Mac or IBM No cards needed!

Liberty Systems
(408) 983-1127
Fax (408) 243-2885

You're ready to work anywhere there's a computer. Send large documents and graphics between locations. Create a multimedia show and take it on the road. There's no end to the uses you will find for these small wonders. "Microscopic" MACWORLD

CIRCLE 861 ON READER SERVICE CARD

3480 800/842-0708
TDX PERIPHERALS
HAUPPAUGE, NY • 516/273-5900
The Only Professional Choice

Excellent Software and Support
All Densities—including 6250
Super Speed & Reliability
3480 Cartridge Drives
& SCSI Too!
FAST 9-TRACK for MICRO'S

CIRCLE 864 ON READER SERVICE CARD

9-Track for PCs
Mainframe to PC data interchange
Rock solid solutions, rock bottom prices.
Direct from the manufacturer. 1600 & 6250 bpi.
Subsystems include drives and software.

800-729-8725
OVERLAND DATA
Since 1980
3480 Now with IDRC!
See us at CeBIT '93
Tel. 619-571-5555 • FAX 619-571-0982
Europe: Tel. +49-6172-35027 • FAX +49-6172-35028
Ask about 3480 tape drives too

CIRCLE 865 ON READER SERVICE CARD

VGA makes it to the
BIG SCREEN

VGA Mate®

Experience the freedom of viewing your presentation on a giant TV in brilliant colors

$169

With a little imagination the applications are endless

NTSC & PAL switchable

Product upgrade guaranteed for one year

Calpac Computer Corporation
53 Moody Court
Thousand Oaks, CA 91360
1 800 800-7222

CIRCLE 866 ON READER SERVICE CARD

MULTICALC
The Total Financial Computing Package

Solving any type of financial problem is a snap with MultiCalc's easy to use interface. Our payment recording system is unique, useful, and reliable. Only MultiCalc has the versatility financial professionals need.

MultiCalc is a powerful collection of business tools. It brings refreshing simplicity and flexibility to tedious and often cumbersome tasks.
PC Magazine - 10/27/92

COMPETITIVE UPGRADE

Better than Amortizer Plus, TValue, or Execamort. Upgrade now to MultiCalc from any of these products for only **$79.**

- Loan Amortization - Simple to Complex ■ Leasing
- Solve for any Unkown ■ Memory Resident Option
- A.P.R. per Regulation "Z" - A.R.M.'s - G.E.M.'s
- Payment Recording System - Prints Payment Book
- Year-End Statements - Late Notices
- Depreciation - SL/DB/SYD/ACRS/MACRS
- Finance - FV/PV/FVA/PVA/IRR/MIRR/NPV/MNPV
- Lotus, Dbase, Quattro, ASCII File Compatible
- Multiple Companies, Multiple Assets
- Bonds - I.R.A. Calculations

PLUS 70 other features that will turn a few keystrokes into a wealth of financial information.

1-800-262-6890 VISA/MC/AMEX/DISCOVER

PC WORKS, INC. - 801 Madrid Street, Suite 105 Coral Gables FL33134

New Version 2.2 **$149**

CIRCLE 868 ON READER SERVICE CARD

Presentation-Perfect Flowcharts — In No Time !

Use Flow Charting 3 for a variety of charting needs

- Flowcharts
- Organizational Charts
- Process Control Charts
- Data Flow Diagrams
- Network Diagrams
- Work Flow Diagrams

If you need a quick and efficient way to construct charts and diagrams, but don't want to spend hours learning a complicated computer program, then take a look at Flow Charting™ 3.

Flow Charting 3's strength lies in its flexibility. Shapes, lines, and text can be placed anywhere on the page. In fact, you can even modify shapes to suit your own purposes and save them for future use.

Flow Charting 3 gives you the power to tailor your charts and diagrams exactly to your own needs and specifications. Then you can quickly and easily include them in your WordPerfect 5.0 or 5.1 document by using our custom export filter.

But Flow Charting 3 is more than flexible, it's easy to use. In fact, with Flow Charting 3 you can be up and running within an hour. If you don't believe us, try it out for yourself.

See your dealer today or call for a free interactive demo.
800-525-0082 ext. **2413**
International: **408-778-6557** ext.**2413**

PATTON & PATTON
Software Corporation

Excellence in charting the flow of ideas!

WordPerfect is a trademark of WordPerfect Corp. Flow Charting™ 3 is a trademark of Patton & Patton Software Corp.
Patton & Patton Software Corporation, 485 Cochrane Circle, Morgan Hill, CA 95037

CIRCLE 867 ON READER SERVICE CARD

Program Your Business For Success

MicroBiz

COMPUTERIZE YOUR BUSINESS & WATCH YOUR PROFITS GROW!

- Increase Control
- Increase Profits & Sales
- Work smarter, not harder
- Lower Costs & Reduce Inventory

We Provide Software That Is:

- ✔ Affordable & Functional
- ✔ Easy to use
- ✔ Tested & Stable
- ✔ Unparalleled In Technical Support

800-637-8268

Main Phone: (914) 425-9500
Fax: (914) 425-4598
BBS: (914) 425-6440
Fax on demand: (914) 426-6064
Dealers Welcome: 800-SELL-POS

CALL TODAY FOR A FREE CATALOG

CIRCLE 869 ON READER SERVICE CARD

Get AMIDiag 4.0 for ~~$149~~ $ 15.

American Megatrends, the makers of AMIBIOS, would like you to throw out your diagnostics toys and try AMIDiag 4.0, a serious diagnostics package. Fill out the form below and mail it in with the front cover or first page from the manual of any other diagnostics package, and **we'll send you AMIDiag 4.0 for only $15** ($/H included).

Name : _____

Address : _____

_____ Phone : _____

VISA/MC # : _____ Exp. Date : _____

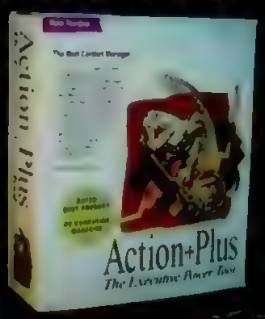
Mail to:
American Megatrends, Inc.
Serious Diagnostics Offer
6145F Northbelt Pkwy.
Norcross, GA 30071

American Megatrends

Offer valid through May 31, 1993. Please allow 4-6 weeks delivery time.

CIRCLE 873 ON READER SERVICE CARD

Clean Up Your Act *with*



The BEST Contact Management
Personal Information Manager
Time Manager- Franklin & DayTimer
Invoicing, Sales Orders, Statements
Sales Performance Graphs
Inventory w/ Serial Number Tracking
Word Processor / Merge / Spell Checker
On-Line Tutorial & User Manual
Graphic Image Display
Speed Dialer - E-Mail
Goals & Project Planning
Expense Tracking
$495.00 Single-User $1495.00 Network

Action Plus Software, Inc.
935 East 7220 South - D-100
Salt Lake City, UT 84047-2393
(801)255-0600 FAX (801)255-0642

Available at Egghead & BizMart

CIRCLE 870 ON READER SERVICE CARD

ANNOUNCING

Computer Select™

The Most Complete Database of Computer Product Information Available

With COMPUTER SELECT you'll never again risk making the costly mistake of acquiring the wrong product. Now, using your own PC, you can identify, evaluate and select the best products that meet your requirements and your budget. Easy-to-use search software lets you quickly retrieve the documents you need from the vast database of product reviews, specifications, announcements and buyer's guides.

Get instant access to more than...

- 70,000 articles and abstracts each month
- Complete specs for 70,000 hardware, software and communications products
- Profiles of 12,000 companies, including addresses and phone numbers
- 9,000 definitions of computer and telecommunications terms.

Discover the power of this new CD-ROM product. Call now for your free, no-obligation demo disk. Then, if you wish, you can subscribe for $995.*

LIBRARY™
One Park Avenue,
New York, NY, 10016

CALL NOW FOR A FREE DEMONSTRATION DISK
212-503-4400

Computer Library and Computer Select are trademarks and Data Sources is a registered trademark of Ziff Communications Company. ©1993 Ziff Communications Co.
*U.S. and Canada only. Outside U.S. $1195

FractalVisions

Price $79.95 per Volume or $129.95 as a bundle plus $5.00 S/H

FL Residents add 6% Sales Tax

- Explore the Fascinating World of Fractals with Fractal Visions CD-ROM Volumes I & II, over 350 GIF 89a Images per Volume 1024 x 768 x 256 Resolution.
- Plus an Added Bonus - 7 Image Viewing Utilities.

MediaScape
P.O. Drawer 3948
West Palm Beach, FL 33402

ORDER: 1-800-982-9264
FAX: (407) 683-8602
Call: (407) 687-0099
Check or Credit Cards Accepted

CIRCLE 871 ON READER SERVICE CARD

CDROMS $24.95

Full money back guarantee

Walnut Creek CDROM
1547 Palos Verdes
Suite 210
Walnut Creek, CA 94596

+1-510-947-5996
FAX +1-510-947-1644

+1-800-786-9907

Simtel20 MSDOS CDROM $24.95
Over 6[illegible] megabytes, 9000+ files. Programming tools, DOS utilities, text, docs, comm, BBS, publishing, ham radio, education, much more. BBS support. December 1992.

CICA MS Windows CDROM $24.95
Hundreds of MicroSoft Windows programs. Games, utilities, source code, programming tools. BBS support. November 1992.

Hobbes OS/2 CDROM $24.95
Thousands of OS/2 programs, including games, utilities, drivers. December 1992.

Source Code CDROM $39.95
600 megabytes of source code for games, utilities, etc. Mostly C. Lots of Pascal, C++, Fortran, Lisp, Modula, Assembly, etc.

The C Users Group Library CDROM $49.95
The entire library of C and C++ source code, volumes 100-364.

[redacted]

CDROM Caddies $ 4.95

CIRCLE 872 ON READER SERVICE CARD

Serious Diagnostics

American Megatrends, makers of AMIBIOS, now brings you *serious diagnostics*: AMIDiag, the only software-based diagnostics to win the **PC Magazine Editor's Choice Award.**

AMIDiag 4.0 features:

- An easy-to-use interface for novice and expert users
- Test motherboard, memory, disk drives, keyboard and video
- The ability to show defective memory modules on the screen
- Cache memory and page/interleave memory tests
- Automated testing and error logging from a script file
- Three testing modes: passbound, timebound or continuous
- System Information module reports hardware and software environment characteristics
- Easy method to link user-based diagnostics to AMIDiag

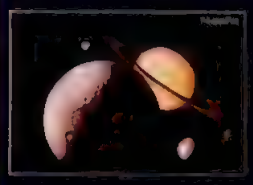
Also available, the best-selling **Diagnostics Kit** with the Diagnostics Card, RAMLess Monitor System, and AMIDiag.

For information and a dealer near you, call :
(800) 828 - 9264
(404) 263 - 8181
(404) 263 - 9381 FAX

American Megatrends

CIRCLE 875 ON READER SERVICE CARD

SuperVGA
Computer Images
Also VGA/EGA/CGA/Mono and Animation
1024x768x256
Photographic Quality Real Color Images



BBS
1-800-GO-MODEM
Toll-Free Lines

Exclusive from Event Horizons, 50,000 top quality, state of the art color MaxiPic GIF images and Sound VGA Movies, all categories, ratings, resolutions.

BBS 800-GO-MODEM, or BBS 503 697-5100. $12/hr. Toll-Free lines $6/hr extra

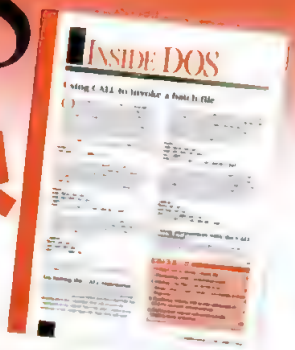
No Modem? Order our Mail Image Library with Samples for $9. World-wide shipment. Info voice line 503-697-7700. Credit cards accepted. Same day shipment anywhere.

Actual computer scanned images

Event Horizons
311 Ave B, Suite 209
Lake Oswego, OR 97034
Information: 503-697-7700

CIRCLE 676 ON READER SERVICE CARD

DOS FREE TIPS!



Inside DOS will show you how to use DOS more productively. You'll find timesaving shortcuts, proven methods, and step-by-step instructions in every information-packed issue. ◆ Subscribe today and we'll send you 13 issues for the price of 12 for only $39! If you decide *Inside DOS* is not for you, mark "cancel" on your invoice and return it. Your free bonus issue will be yours to keep with no further obligation. ◆ *Inside DOS* is guaranteed to help you get the most out of DOS. But don't take our word for it. See for yourself.

Call for your FREE ISSUE today!
1-800-223-8720
Please mention code V5NX

Is the pressure on to justify how you spend your training dollars?

In these days of tight budgets, you need solid proof of the value of training.

That's why Logical Operations has developed the Skills Evaluation Series™: software-skills tests that you can use to assess basic software skills, screen to determine training requirements, and measure training effectiveness.

Each Skills Evaluation contains 20 multiple-choice questions with a manually or automatically scored answer card. Most evaluations are "hands-on," where students must be using the actual software and the sample files provided in order to complete the evaluation.

Fully validated, and designed to work with Logical Operations' classroom training materials (if you use them!), Skills Evaluations are available for most major software applications including, **Word for Windows, WordPerfect 5.1, Macintosh Orientation System 7, PC Literacy, 1-2-3 Release 3.1, Windows 3.1 Orientation, and Excel 3.0 for Windows.**

At only $78 for a Skills Evaluation Starter Package, you'll get an information-packed Administrator's Guide, answer key, and a 10 pack of tests. Additional 10 packs are available for $50.

Skills Evaluation Series™

Order now — it might prove to be the most cost-effective thing you'll do today. **Call 1-800-456-4677, ext. 40 to receive a FREE evaluation,** and prove the value of your training today.

Logical Operations
Learn from us.

Skills Evaluation Series is a trademark of Logical Operations. All other copyrights are trademarks or registered trademarks of their respective owners.

ADULT

Explore the Internet!

DELPHI is the only major online service to offer you full access to the Internet. And now you can explore this incredible resource with no risk. You get 5 hours of evening/weekend access to try it out for free!

Use DELPHI's Internet mail gateway to exchange messages with over 10 million people at universities, companies, and other online services. You can even subscribe to mailing lists, with no per-message fees. Download programs and files from all over the world using "FTP" or connect in real-time to other networks using "Telnet."

To help you find the information you want, you'll have direct access to powerful search utilities such as "Gopher," "Hytelnet," "WAIS," and "the World-Wide Web." If these terms sound strange to you, don't worry; DELPHI has expert online assistants and a large collection of help files, books, programs, and other resources to help get you started.

Over 600 local access numbers are available across the country. Explore DELPHI and the Internet today. You'll be amazed by what you discover.

Attention Current Internet Users:

See what DELPHI can offer you! Stock quotes, Grolier's Encyclopedia, newswires, and hundreds of other services are just a few keystrokes away. Telnet to delphi.com and enter the username and password at right for a free trial.

5-HOUR FREE TRIAL!
Dial By Modem 1-800-365-4636
At Username, enter JOINDELPHI
At Password, Enter PMG33B

DELPHI

Questions? Call 1-800-695-4005 Send e-mail to INFO@delphi.com

CIRCLE 878 ON READER SERVICE CARD

ROM BIOS UPGRADES

For Your IBM or Compatible-A New BIOS Upgrade Will.
• Support Windows 3.0/3.1 • Support 360K, 720K, 1.2MB & 144MB Floppy Drives
• User defined hard drive types • Support VGA • Novell & Netware compatible
• Expanded hard drive table • Enhanced 101 102 keyboard • 100% IBM compatible
• Complete documentations • DOS 5.0 • Latest Version • Complete set up in ROM.
• PS/2 Mod 30 **FREE INTEL CHIP PULLER**

ROM BIOS UPGRADES AVAILABLE FOR:

• IBM	• Sperry	• Hyundai	• Wyse
• Acer	• Northgate	• Sanyo	• Kaypro
• Leading Edge	• Tandy	• Samsung	• Compaq
• DTK	• AST	• Wells American	• Everex
• Dell	• AMI	• Epson	• And Many More

ORDER TODAY
1-800-800-2467
UNICORE SOFTWARE
1630 Turnpike St. • North Andover, MA 01845
(508) 686-6468 • FAX (508) 683-1630

CIRCLE 879 ON READER SERVICE CARD

IBM • TATUNG • PANASONIC • ZEOS • SHARP • NORTHGATE • HYUNDAI • AST • SANYO • LEADING EDGE • DTK • SPERRY • COMPAQ • KAYPRO • SAMSUNG • ACER

ROM BIOS UPGRADES

Solve Your Compatability Problems!

8 Years of experience, unmatched in the industry
WE STOCK THE LARGEST VARIETY OF ROM BIOS UPGRADES IN THE WORLD.

AMI PHOENIX MR BIOS AWARD

FEATURES OF A NEW BIOS

• MEMORY UPGRADES
• MOTHERBOARDS
• BIOS Reference Manuals
• DIAGNOSTIC PRODUCTS

SmartMicro TECHNOLOGIES, INC.
(800)-ROM-BIOS 7 6 6 2467
FAX 626 371-0012 TEL (Business) 0055

• FREE Catalog • FREE Chip puller • FREE Tech support • Volume Discounts
• Univ. & Corp POs Welcome • Same Day Shipping • DEALERS WELCOME - Call for special pricing, free bios resellers kit • Authorized Micronics BIOS Distributor

WE WILL BEAT ANY ROM BIOS COMPETITORS PRICE!
143 TRIUNFO CANYON RD, SUITE 103 • WESTLAKE VILLAGE, CA 91361
• GATEWAY • EPSON • TANDY • DELL • NCR • EVEREX • COMPAQ • NEC • WYSE

CIRCLE 880 ON READER SERVICE CARD

Get ahead in business

In the fast-paced business world, little things make big differences...like a compact, lightweight headset from GN Netcom. Experience the benefits of hands-free communication:

• increase productivity by up to 43%
• double your call volume
• improve efficiency at a computer terminal
• prevent neck and back strain

Choose from five sleek, comfortable designs... all compatible with any phone system.

Use your head to get ahead... and call today
1-800-826-4656

GN Netcom

CIRCLE 882 ON READER SERVICE CARD

Total Recall

Powercard® IPS

WINDOWS

Windows Magazine -"No matter what I tried, the IPS flawlessly saved the system state and shut down. It then restored the system to where I left off".
by Stan Miastkowski

1993 ANNUAL WINDOWS 100 W MAGAZINE WIN AWARD

AutoSave & AutoResume with Power Protection

Tired of having to open and close applications one by one every time you turn on or turn off your computer?

Powercard®IPS is a built in battery backup system that totally protects your computer and data from power outages. You want to go? Just turn the computer off – no matter what it's doing. It will preserve your computer's environment and then turn itself off. Upon returning, you can instantly resume your work exactly where you left off, with total recall.

Powercard®IPS will work in the middle of any process – calculating, reading or writing files and even while optimizing a hard disk. It's also compatible with dual monitor support, which allows you to work on text and graphics (Lotus*, AutoCAD*) simultaneously. The entire process takes about ten seconds. All modes of Windows* 3.x, are supported, as well as virtually all non-Windows* applications, including Stacker*, SuperStor*, etc...

MICROSOFT® WINDOWS™ COMPATIBLE

AUTODESK REGISTERED DEVELOPER

yes It runs with NetWare

Powercard® IPS – For power users who don't have time to waste.

To order this timesaving product, call:
(305) 251-5855 or 1-800-637-2797
FAX (305) 251-2334 • Major Credit Cards Accepted
Dealer and reseller programs available

Powercard® IPS
$299
Plus S & H

*Trademark or Registered Trademark of their respective manufacturer. • Windows is a registered trademark of Microsoft Corporation • Powercard IPS is not an Autodesk product • The Autodesk logo is a registered trademark of Autodesk Inc. • © Copyright 1992 Powercard Supply L.C. 12231 S.W. 129th Ct. Miami, Florida 33186 All rights reserved

CIRCLE 881 ON READER SERVICE CARD

CREATE YOUR OWN PERSONAL*CD*!

We can transfer up to 640MB of information to ONE CD-ROM! - For just $269.00!

We will take your cartridges, DAT, Exabyte or other media, and within 3 business days create a Personal*CD*. If you can't be without your media, ask us about our Tape Drive Loaner Program. Call for details and ordering information. Return shipping is free.

Save money, get your data secured, and make it accessible instantly... *Get a Personal*CD *made for you today!*

ISOMEDIA™
Optical Data Storage Specialists

(800) 468-3939
(206) 869-5411
(206) 869-9437 Fax

14808 NE 31st Circle • Redmond, WA 98052

CIRCLE 883 ON READER SERVICE CARD

WINDOWS™

FREE ISSUE!

Inside Microsoft Windows is guaranteed to help you get the most out of Windows. But don't take our word for it. See for yourself.

Subscribe today and you'll get 13 issues for the price of 12 for only $39! If you decide *Inside Microsoft Windows* is not for you, mark "cancel" on your invoice and return it. Your free bonus issue will be yours to keep with no further obligation.

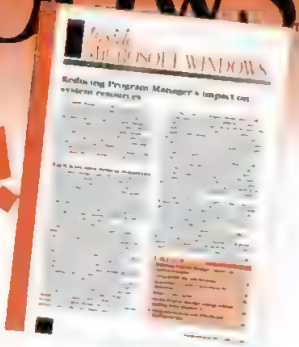
Call for your FREE ISSUE today!

1-800-223-8720

Please mention code V5NW

WINDOWS™

FREE TIPS!



Inside Microsoft Windows will show you how to use Windows more productively. You'll find timesaving shortcuts, proven methods, and step-by-step instructions in every information-packed issue.

◆ Subscribe today and we'll send you 13 issues for the price of 12 for only $39! If you decide *Inside Microsoft Windows* is not for you, mark "cancel" on your invoice and return it. Your free bonus issue will be yours to keep with no further obligation. ◆ *Inside Microsoft Windows* is guaranteed to help you get the most out of Windows. But don't take our word for it. See for yourself.

Call for your FREE ISSUE today!

1-800-223-8720

Please mention code V5NV

Instant Recall

PCResume®

PC MAGAZINE

PC Magazine - "This nifty utility lets you resume working the next day without having to reload and open applications and files".
by Emerson Andrew Torgan

PCResume®

PC WEEK

PC WEEK - "... a utility that "remembers" where users left off before shutting off, allowing them to resume tasks immediately after boot-up".
by PC WEEK Staff

AutoSave & AutoResume

Tired of having to open and close applications one by one every time you turn on or turn off your computer?

With *PCResume®* you can just hit a hot key, within seconds the entire computer's environment is preserved and saved to disk – even in the middle of processing, then shut your computer off. Upon returning, you can instantly resume your work exactly where you left off.

PCResume® will work in the middle of any process – calculating, reading or writing files and even while optimizing a hard disk. It's also compatible with dual monitor support, which allows you to work on text and graphics (Lotus*, AutoCAD*) simultaneously. The entire process takes about ten seconds. All modes of Windows* 3.x, are supported, as well as virtually all non-Windows* applications, including Stacker*, SuperStor*, etc...

MICROSOFT® WINDOWS™ COMPATIBLE

AUTODESK REGISTERED DEVELOPER

yes It runs with NetWare

PCResume® – For power users who don't have time to waste.

To order this timesaving product, call:

(305) 251-5855 or 1-800-637-2797

FAX (305) 251-2334 • Major Credit Cards Accepted

Dealer and reseller programs available

***PCResume®* $49** Plus S & H

*Trademark or Registered Trademark of their respective manufacturer • Windows is a registered trademark of Microsoft Corporation • PCResume is not an Autodesk product. • The Autodesk logo is a registered trademark of Autodesk, Inc. • © Copyright 1992 Powercard Supply LC 12231 S W 129th Ct Miami Florida 33186 All rights reserved

CIRCLE 884 ON READER SERVICE CARD

30-DAY RISK FREE 100% SATISFACTION GUARANTEE

5 YEAR WARRANTY

"Your PC Magazine Memory Source for over 4 years!"

INFINITY

MEMORY PRODUCTS & UPGRADES

MEMORY HOTLINE

(415) 398-2987 Fax: (415) 398-5482

DRAMS

	100NS	80NS	70NS
1MB X 1:		$4.15	$4.25
256K X 4:		4.49	4.69
256K X 1:	$1.49	1.99	2.10
64K X 4:		1.75	

*Call for prices on 60NS DRAM

IBM TYPE SIMMS SIPPS

	80NS	70NS	60NS
9-CHIP:			
4MEG X 9:	$132	$139	$155
1MEG X 9:	35	36	38
3-CHIP:			
1MEG X 9:	33	34	36

*Please add $2 for SIPPS

72-PIN SIMMS

512K X 36-80NS	(2MB)	$85
1MB X 36-80NS	(4MB)	$159
1MB X 36-70NS	(4MB)	$169
2MB X 36-70NS	(8MB)	$299
4MB X 36-70NS	(16MB)	$809

PS/2 UPGRADES

30/286	
2 MB KIT	$89
386SX; 486SX; 9552; 9553; 70's	
2 MB	$79
386SX; 486SX; 556X; 655X/L3	
4 MB	$149
386SX/LS; 486SX; 575X; 90; 95	
8 MB	$299
EXP BRD: 50; 502; 80; 550X; 655X	$235
EXP BRD: All Models 70 & 80	
2–14 MB w/2 MB	$249
4–16 MB w/4 MB	$325
PS/2 L40SX/N33SX LAPTOPS	
2/4/8 MB	$89/150/319
PS/1 UPGRADES	
2/4MB	$ LOWEST

MATH COPROCESSORS

	INTEL	CYRIX
80387/SX	$89	$75
80387/DX-33	$89	$85
80487/SX	$ LOWEST	

LAPTOP UPGRADES

COMPAQ	
CONTURA 386SX 20/25	
2/4/8 MB	$LOWEST
LTE 386S/20	
4 MB	$189
SLT 386S/20	
2/4 MB	$109/179
TOSHIBA	
1200XE; 1600; 3100E	
2 MB	$95
3100SX; 3200SX/SXC	
2/4 MB	$95/175
4400SX; 6400	
2/4/8 MB	$129/199/349
AST EXECUTIVE	$ LOWEST
DELL	$ LOWEST
TI TRAVELMATES	$ LOWEST

DESKTOP UPGRADES

COMPAQ DESKPRO	
286E; 386-20/20E; 25/25E	
4 MB	$179
386S/16	
4 MB	$179
386-20E/25E; 386S/16	
4-12 MB EXP BRD	$229
286N; 386N; 386SX/20; 486M's	
2/4 MB	$85/159
386/33L; 486-25/33L; SYS PRO	
2/8 MB	$185/335
PROLINEA	$ LOWEST
AST PREMIUM	$ LOWEST
DELL	$ LOWEST
GATEWAY 2000	$ LOWEST
MAGNAVOX	$ LOWEST
PACKARD-BELL	$ LOWEST

LASER PRINTER UPGRADES

HP II; IID; IIP; III; IIID; IIIP+	
2/4 MB	$105/175
HP IV	$ LOWEST
PANASONIC 4420; 4450i	
2/4 MB	$125/199
PANASONIC 4410/4430	
2/4 MB	$135/209
IBM 4019; 4019e	
1/2/3.5 MB	$75/115/159
IBM 4029	$ LOWEST
EPSON EPL6000	
2/4 MB	$121/185
EPSON ACTIVLSR II	$ LOWEST
OKI 400	
1/2 MB	$72/109
CANON LBP; HP IIsi, MEC SW, TI MICLSR	$ LOWEST

TERMS & CONDITIONS

- 30-DAY MONEY-BACK GUARANTEE.
- Price & availability subject to change.
- 15% restocking fee on non-defective returns & refused orders.
- Shipping charges are non-refundable.
- No surcharge on VISA/MC.
- PO'S accepted from government and qualified firms.

INFINITY MEMORY PRODUCTS
633 Post Street, Box #197
San Francisco, CA
94109-8215

CIRCLE 576 ON READER SERVICE CARD

Laptop Memory

PCMCIA 2.0 *SRAM Cards:*

RJB-0512	512Kb	$ 95
RJB-1000	1Mb	$175
RJB-2000	2Mb	$295

Powerbook:
100/140/145/160/170/180

Toshiba:
1000XE/SE/LE, 1800, 1850, 2000, 2000SX/SXE 3300SL 4400SX

Printer Sharing

LOGICAL CONNECTION

800-238-9415

FAX: 503-390-6372

CIRCLE 577 ON READER SERVICE CARD

REMOTE ACCESS

Office & Home Computers
Network/Servers • Remote Booting

- Call-in & activate computer On or Off with touch-tone control.
- 1-10 Selectable rings with answer machine compatibility.
- Increase security. Save energy. Extend hardware/disk life.
- Compatible w/all communications & remote control software.
- Additional Multi-Unit Remote Control options available.
- UL listed - FCC Registered- Fully Guaranteed.

$129.95+ $4.00 S/H

Vant Systems Inc. 5210 Lewis Rd Bldg 8, Agoura Hills, CA 91301

1•800•266•1733 Ext. 140
Tel 818-706-1733 Fax:818-879-2643

CIRCLE 578 ON READER SERVICE CARD

486-66 MHz EISA

Since 1985, MSE has been dedicated to bringing you high-quality American designed, engineered and built computer systems for a wide range of applications. NOW, for our 8th year anniversary special, we are proud to introduce our fastest and most powerful machine, the 80486-66MHz or 33MHz.

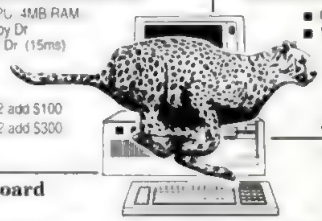
MicroCache 386-33MHz $795

- 80386-33MHz CPU, 32 Bit
- Upgradable to 486DLC-33MHz
- 4MB RAM, expands to 32MB
- 125MB Fast Dr. (15ms)
- 1.2MB Floppy Dr.
- 2 Serial/Parallel
- Enhanced Keyboard
- 64K Cache
- 40MHz Add $20

MicroCache 486-33MHz

- 80486-33CPU 4MB RAM
- 1.2MB Floppy Dr
- 210MB Fast Dr (15ms)
- 64K Cache
- Enhanced Keyboard
- 50 MHz DX2 add $100
- 66 MHz DX2 add $300

$1195



MicroCache 486 EISA-33MHz

- Intel 80486-33CPU 4MB RAM
- 1.2MB Floppy Dr
- 340MB Hard Disk Dr (13ms)
- 128K Cache expandable to 256K
- 50MHz DX2 add $100
- 66MHz DX2 add $300

$1595

Motherboard Special

- 486SX-25MHZ W/4MB RAM $449
- 386-33MHz W/64K Cache/4MB RAM $349
- 486-33MHz W/64K Cache/4MB RAM $649
- 486-50MHz DX2 W/64K Cache/4MB RAM $749
- 486-66MHz DX2 W/64K Cache/4MB RAM $949
- 486 VLB-66MHz W/128K Cache/4MB RAM $999
- 486 EISA-33MHz W/128K Cache/4MB RAM $849
- 486 EISA-66MHz DX2 W/128K Cache/4MB RAM $1149

Expansion Options

- Nanao F550 i Monitor 17" $1099
- ATI Graphics Ultra Pro $499
- Intel EtherExpress 16 $129
- SVGA (1024 x 768) Monitor 14" $299
- TVGA Card (1024 x 768) 1 MB $99
- Paradise Windows Accelerator 1MB $149
- NEC Seiko/Hitachi 20" Monitor $Best
- EISA Caching Disk Controller (0 3ms) W/512K RAM $399

Hard Disk SCSI-2

- Micropolis 2.0GB MC 1924 $2599
- Micropolis 1.7GB MC 1548 $1999
- Toshiba 1.2GB MK538 $1499
- Maxtor 1.0GB PO 12S $1399
- Maxtor 540MB LXT 535S $599
- Maxtor 340 MB LXT 340S $899

CD & Multimedia
SCSI/NT Compatible

- NEC CDR-84 SCSI/NT $549
- NEC SCSI Host Adapter $99
- Sony CDU-541 SCSI/NT $449
- Adapter AHA-1510 CD $99
- Toshiba CD-3401 (200ms) $499

VESA Local Bus

- Micronics 486SX-25MHz VLB W/4MB $649
- Micronics 486DX2-66MHz VLB W/4MB $1149
- Diamond Stealth 24 VLB 1MB $179
- ET-4000 24X VLB 1MB RAM $129

No Slot CD-ROM
Notebook & desktops

- NEC CDR 74 Kit (280ms) $749
- Texel DM 5024 Kit (265ms) $649
- Kit includes External/Drive Controller Cable Software

Sales Hours:
Monday - Friday
9:00 AM - 5:30 PM
Saturday
10:00 AM - 3:00 PM
PST

MS ENGINEERING, INC.

10601 S. De Anza Blvd., Suite 214, Cupertino, CA 95014
(408) 257-4249 FAX: (408) 257-4396

CIRCLE 580 ON READER SERVICE CARD

AmRam — LOW WAREHOUSE PRICES!

1MB SIMM 80ns $31 4MB SIMM 80ns $129

TYPE	PKG.	100ns	80ns	60ns
256K x 1	DIP	$1.19	$1.21	$1.49
256K x 4	DIP	$3.84	$4.02	$4.32
1M x 1	DIP	$3.59	$3.69	$3.75
256K x 9	SIMM	$6.99	$9.64	$10.92
		80ns	70ns	60ns
1M x 9 3 chip	SIMM	$31.00	$33.50	$34.00
1M x 9 9 chip	SIMM	$34.50	$34.75	$35.50
4M x 9 9 chip	SIMM	$129.00	$133.00	$143.00

MATH CO-PROCESSORS/CPUs

80387-SX	16-25	INTEL	$76.47
80387-DX	16-33	INTEL	$82.35
83SX87	16-25	CYRIX	$75.30
83DX87	16-33	CYRIX	$86.00
83D87-40		CYRIX	$115.00
2C87-8		IIT	$54.00
2C87-12		IIT	$55.48
ODP486-DX2	66MHZ	INTEL	$655.00
ODP486-DX2	50MHZ	INTEL	$495.00

408-559-0603

FAX 408-559-0301

2989 Camden Ave., #338 San Jose, CA 95124

All merchandise 100% guaranteed. We accept VISA, MC, Discover and company PO's with prior approval. Prices, delivery and merchandise subject to change. Minimum order $100. Returns require RMA#, non-defective returns subject to a 15% restocking fee.

Up to 43% off!

IBM PS/2's

		IBM Retail	Your Cost
MODEL 30-286/E01	0MB	1,625	395
MODEL 35-040	0MB	1,310	875
MODEL 55-081sx	80MB	2,000	1,150
MODEL 57-045	80MB	1,950	1,395
MODEL 70-081	80MB	2,075	1,475
MODEL 70-A81	80MB	2,275	1,650
MODEL 80-081	80MB	3,825	2,550
MODEL 80-A31	320MB	5,825	3,475
MODEL 90-0K9	160MB	3,730	3,225
MODEL 95-0KD	320MB	4,958	4,250
MODEL 95-0KF	400MB	5,250	4,500
8512/8513			325/350

We also carry the FULL IBM, COMPAQ, and H.P. Lines. Call For Latest Pricing

AMERICAN MICRO COMPUTER CENTER
6073 NW 167th Street • Unit C-27
Miami, FL 33015
PH: (305) 825-5565 FAX: (305) 825-7774

CIRCLE 579 ON READER SERVICE CARD

Bar Code Headquarters

Offices in USA and Europe!

Labeling Software

- For IBM PC, with Dot Matrix and LaserJet
- WYSIWYG or Text Design
- Any Format, Any Size Label
- Sears, K-Mart, Penny's, WalMart, AIAG, UCC-128, UPC/EAN, 2of5, Codabar, & Code 39
- Big Text and PCX Graphics too!
- Import ASCII datafiles from Lotus, dBase, etc.
- Powerful, Versatile, Easy to Use
- LabelRIGHT™ Thermal for Zebra, Sato and Fargo Printers – **$379**
- LabelRIGHT™ Dot Matrix & LaserJet – **$279**
- Other menu driven programs from – **$129**

Portable Bar Code Readers

for PC,XT,AT,PS/2,Macintosh, and Serial Interface Computers

- Battery Operated Reader — 3 AA Cells
- 64K or 256K memory
- Keyboard or Serial Interface upload
- Downloaded Tables
- XMODEM upload
- Codabar, UPC/EAN, Code 128, I 2of5, MSI, Code 39
- Double duty as Non-portable Reader
- 2 Built-in Inventory Programs supplied or write up to 3 user defined programs
- Long Battery Life – 30,000 wand scans
- Very Easy to Program, Prompts & Time
- Complete 64K unit with Laser – **$1734**
- Complete 64K Unit with Wand – **$799**

Bar Code Readers

for PC, XT, AT, PS/2, Macintosh and RS-232 Terminals

- Attaches as 2nd Keyboard
- UPC/EAN, Code 128, 2of5, MSI, Code 39
- Wand, Magstripe, CCD, Slot Badge or Laser
- All European Keyboards Supported
- Superior Read Rates. Made in USA.
- Top Rated by Independent Reviews
- Complete with Symbol Laser – **$1389**
- Complete with Steel Wand – **$399**
- MagStripe Units – **$219**

Ordering is Easy!

- **Made in the USA**
- **Free "800" Support**
- **Qualified P.O's Accepted**
- **2 Year Warranty on Readers**
- **Same Day Shipping**
- **Free UPS Blue in US**
- **30 Day Money Back Guarantee**

In US or Canada Call Toll Free

800-345-4220

In Europe call information for Toll Free numbers to our Swiss Office

Swiss Office:
Rütistrasse 6
9050 Appenzell, Switzerland
71 87 51 17 Fax • 71 87 51 15

US Office:
417 Ingalls Street
Santa Cruz, CA 95060
408-458-9964 fax • 408-458-9938

WORTHINGTON
DATA SOLUTIONS

GOT COMPUTER RED EYE?

BUY the GLARBUSTER™

ELIMINATE ALL GLARE.
REDUCE EYE FATIGUE.
Maximize Privacy and Security.

ONLY $99.00

Easy to Install. Comes Assembled.
Adjustable. Fits Most Monitors.

Send check or M.O. only to,
GLARBUSTER COMPANY
980 Post Road East Suite 3
Westport, CT 06880-5300
203-221-0481
allow 6-8 wks delivery
Add $5.00 Shipping/Handling
Patented, Intl. Pt. Pend.
Money Back Guarantee.

CIRCLE 581 ON READER SERVICE CARD

ITS BAR CODE READERS

More Features, More Affordable

NEW IMPROVED

Starting at $279 with wand! ▪ Transparent operation ▪ No software required ▪ PC, XT, AT, Mac, PS2, others. Look into our full line of reliable, competitively priced readers, keyboard and serial wedges, portable data collectors, multi-drop readers, wands, laser scanners, mag stripe readers, and bar code printing software ▪ OEM and reseller discounts. We provide solutions to systems! Custom application software for Data Collections available. Call for details.

East Coast 800-826-1688
West Coast 800-228-9487

INTERNATIONAL TECHNOLOGIES & SYSTEMS CORP. ITS

9201 Forest Hill Ave., Suite 108,
Richmond, VA 23235
(804) 272-0138, Fax (804) 272-0357
655-K North Berry St., Brea, CA 92621
(714) 990-1880, Fax (714) 990-2503

CIRCLE 582 ON READER SERVICE CARD

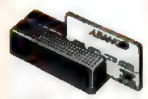
BAR CODE READERS

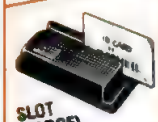
AMERICAN MICROSYSTEMS

2190 Regal Pkwy. • Euless, Texas 76040 • (817) 571-9015

FOR PC, XT, AT, PS/2 & TERMINALS:

- No software changes required
- Data appears as keyboard input
- Reads Code 39, I-2of5, UPC/EAN, Codabar 11, 93, 128, MSI/Plessey
- Auto-discriminates between codes
- Accepts WAND, SLOT, MAG STRIPE, CCD, LASER
- Easy To Use


MAG STRIPE


SLOT (BADGE)

WAND

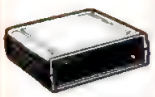
LASER

CCD

METRO LASER

BAR CODE PRINTING SOFTWARE:

- For Epson, OKI, IBM, Dot Matrix and HP LaserJet Printers
- Prints Code 39, I-2of5, UPC/EAN, Codabar, 128, 93, 11, MSI/Plessey


DECODER BOX

PORTABLE READERS:

- Use as a portable, wedge or terminal
- Input Devices: WAND, CCD, or 5V LASER
- Real-time clock for date and time stamps
- Automatic power off with resume
- "Built-in" Inventory programs
- 54 key alpha/numeric keyboard
- Supports HAYES compatible modems

VISA MasterCard

(800) 648-4452 • FAX: (817) 685-6232

30 Day Money Back Guarantee

One Year Warranty

SAVE ON

9 TRACK TAPE SYSTEM

FOR IBM PC/XT/AT 286/386/486

- Mainframe to PC Data Transfer
- High Speed Backup, Data Compression
- Data Extraction, Database Compatible
- Ready to Operate Systems
- Service and Support, Easy Installation
- 3480 & Cartridge Tape Systems

call (919) 763-8400 or write to:

WILTEC Inc.

P.O. Box 7368 Wilmington, NC 28406

WILTEC

CIRCLE 594 ON READER SERVICE CARD

CHURCH SOFTWARE

Discover for yourself why more churches are choosing Power Church Plus.®

Try out the leading membership and accounting package.

Call today for your **free** full-working **Demo**.

F1 SOFTWARE,
208 Ridgefield Drive,
Asheville, NC 28806

(800) 486-1800

CIRCLE 587 ON READER SERVICE CARD

The Mail Order Wizard™

A complete order-processing system for any size mail-order company. Includes list management, charge-card approvals, UPS manifest, and reports galore!

Systems from $495 to $6995

Call for free information or $20 demo. See why *Home-Office Computing* awarded the Wizard ☆☆☆☆

The Haven Corporation
802 Madison St., Dept. M93
Evanston, IL 60202-2207

800-860-0098
(outside the U.S. 708-869-3553)

CIRCLE 585 ON READER SERVICE CARD

THE DATA ENTRY SOFTWARE SYSTEM FOR PCs

KeyEntryIII®

Announcing Version 6.0!!

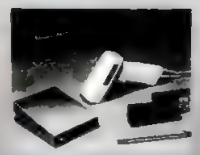
- Completely revised and redesigned documentation
- Totally new user interface
- New pull down menus, windows, and dialog boxes
- Powerful editing capabilities
- Enhanced data formatting capability
- Upgradable to ImageKey™ for image-assisted data entry

Call 800-533-6879 for more information!

SCS Southern Computer Systems, Inc.
205-251-2985 ■ FAX 205-322-4851
In UK: SCS Europe Ltd.
0753-536550 ■ FAX 0753-536765

Bar Code & Magnetic Stripe Readers

For PC/XT/AT, PS/2, and RS-232 Interface



- Direct keyboard interface, no software change
- Reads UPC, EAN, Code 39, 11, 128, I 25, Codabar, MSI
- Direct from manufacturer, 30 day money back guarantee
- Reader with steel wand – $299, with Magnetic Strip Scanner – $199
- Bar Code labeling software from $99
- Reseller discount available, direct from manufacturer

IBS-Intelligent Barcode Systems

(800) 765-2271

26031 Kaplan Ave., City of Industry, CA 91745

Tel (818) 968-8285 Fax (818) 968-8287

CIRCLE 583 ON READER SERVICE CARD

BAR CODE PRINTING

BEAR ROCK MEANS BAR CODES

1(800)232-7625

- Bear Rock Labeler™ Windows labeling program with eleven bar code symbologies.
- PrintBar™ Bar code font packages for the Macintosh.
- Printbar II™ Dos memory-resident bar code package for PCs.
- PrintBar SoftFonts™ Soft font package for LaserJet printers.
- PLUS: Source code, readers, scanners, and much more!

For more information call:

1-800-232-7625

BEAR ROCK SOFTWARE

4140 Mother Lode Drive • Shingle Springs, CA 95682

(916) 672-0244 • FAX (916) 622-4775

MAIL ORDER MANAGER™

America's most popular, most complete, and most affordable solution for the mail order business—order entry/review, credit card processing with draft capture, UPS manifesting, profit analysis, accounting, telemarketing, list management. Clipper compiled, dBase III + files. Single and Multi-user versions. Find out why more people buy MOM after comparing! Call for demo kit.

Dydacomp Development Corporation
150 River Road, Suite N1, Dept PCM
Montville, NJ 07045

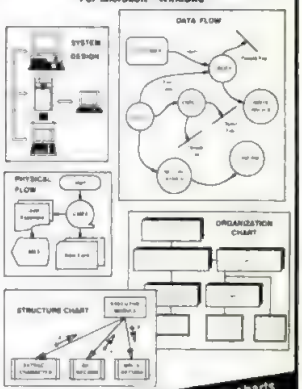
1-800-858-DMOM
201-335-1258

CIRCLE 586 ON READER SERVICE CARD

RFFlow

Professional Flowcharting

For Microsoft® Windows™



Create professional, fine quality charts quickly and easily. Call for free trial disk: (303) 663-5767 FAX (303) 669-4889

$129.00

RFF ELECTRONICS

1053 Banyan Court Loveland, CO 80538

CIRCLE 589 ON READER SERVICE CARD

They all laughed when I spoke to my computer...

Until they discovered that it understands my voice, thanks to the Telaccount Speech Recognizer. TSR works with existing Sound Blaster or compatible hardware to easily add accurate voice recognition to most DOS programs. Just $119. Order today.

Call 215-664-2410

Telaccount Inc. 421 Anthwyn Road, Narberth PA 19072

Sound Blaster trademark Creative Labs

CIRCLE 589 ON READER SERVICE CARD

B.S. & M.S. In Computer Science

- ALL COURSES HOME STUDY
- Approved for tuition reimbursement by leading corporations
- Increase your earning power
- Join students from leading computer companies
- Approved Ada course available

FOR FREE INFORMATION CALL **1-800-767-AICS**

AMERICAN INSTITUTE COMPUTER SCIENCES

The leader in career training

A chain is as strong as its weakest link.

Picture your Hardlock™ key as a bike lock, and the accompanying software routines used to implement the copy protection as the chain. You can own the best lock that money can buy, but that lock is useless if the chain is weak.

Introducing **HL-Crypt**, a major breakthrough in copy protection. HL-Crypt is not just a shell or simple conditional response checker. Using our proprietary Patcher Technology, HL-Crypt encrypts and binds the application to your Hardlock™ device. HL-Crypt features many protection modules that secure the application against piracy, reverse engineering, and debugging, to name a few.

Picture HL-Crypt as an ironclad chain. The only ironclad chain in the industry today.

For more information, call

1-800-562-2543

HL-Crypt

The Fortified Protection Linker for Hardlock

GLENCO ENGINEERING INC.

270 Lexington Drive
Buffalo Grove, IL 60089-6930
Phone 708/808-0300
Fax 708/808-0311

CIRCLE 591 ON READER SERVICE CARD

Slide Imagers

Digital Output

- Slides, Prints, & CDs
- Hi-Res Color Overheads
- Canon Color Lasers
- Photographic Color Prints
- Color Pre-Press Proofs
- Color/B&W Scanning
- Short-Run Color Printing
- Communication Design
- Quantity Slide Dupes

12-HOUR TURNAROUND

The BEST Prices & Support

Call for info! 800-232-5411
404-874-6740

22 Seventh St • Atlanta, GA 30308

CIRCLE 590 ON READER SERVICE CARD

PROTECT YOUR SOFTWARE TODAY

EVERLOCK 3.0

Software Solution

- ☑ OPTION BOARD SAFE
- ☑ CPU LOCK
- ☑ REMOTE REGISTRATION
- ☑ CD ROM LOCK
- ☑ WINDOWS COMPATIBLE

with over 14 new features you have asked for over the years. If Software based protection is what you need, don't settle for anything less than **EVERLOCK 3.0.**

EVERKEY LOCKS & BUTTONS

Hardware Solution

We have combined the Versatility of Az-Tech Software and the **ONE WIRE** Hardware Compatibility of Dallas Semiconductor in the new **BUTTON** package. With It's PRICE advantage and added Flexibility, EVERKEY BUTTONS will lead us into a **dongleless** world.

As your partner in the fight against Software Pirates, Az-Tech is the only company that offers you these options in both a Software and a Hardware Solution:

DATE & EXECUTION LIMITS* COMPRESSION *ENCRYPTION * SERIALIZATION* REMOTE RESET

These systems are easy to use and most importantly, they work! No other company can provide you the Compatibility, Flexibility, Ease of Use and Degree of Protection that you receive with all Az-Tech products.

Az-Tech Software, Inc.

LEADERS IN SOFTWARE SECURITY

201 East Franklin, Suite 11 Richmond, MO 64085
(816) 776-2700 FAX (816) 776-8398

Call Today For A Free Demo

1-800-227-0644

CIRCLE 592 ON READER SERVICE CARD

Key-Lok™ Security

- ☐ Fighting piracy since 1982.
- ☐ Algorithmic response
- ☐ Programmable memory
- ☐ Very economical
- ☐ Device transparent to PARALLEL /SERIAL port
- ☐ Multiple security layers
- ☐ Counters/Real-time clock
- ☐ Multiproduct licensing
- ☐ DOS/UNIX/VMS/etc

Access Control System

Diskette Drive Locks

Microcomputer Applications
3167 E. Otero Circle
Littleton, CO 80122
(303) 770-1917

CIRCLE 803 ON READER SERVICE CARD

REMOVE HARDWARE LOCKS

Maintain Productivity!

Software utility that allows for the removal of hardware locks

Easy-Simple-Guaranteed

These and others are available:

MaxRoute	$250.00
Pads PCB	$99.00
CadKey	$99.00
MasterCam	$250.00
Tango PCB II	$99.00
MicroStation	$99.00
PCAD	$250.00

Visa and Mastercard Welcome
Call or Fax for more information

SafeSoft Systems Inc.
202-1100 Concordia Ave.
Winnipeg, MB
Canada R2K 4B8
PH (204) 669-4639
FAX (204) 668-3566

CIRCLE 596 ON READER SERVICE CARD

CONVERSIONS between Word Processors
CD-ROM mastering & duplication
DUPLICATION of diskettes/tapes
OCR SCANNING of documents

2500 Word Processing & Computer Formats, 3½", 5¼", 8" DISKS, 9-TRACK, 3480, 8mm, 4mm, Colorado, Mountain, DC2120, TK50 TAPES, ¼" Tapes, Syquest & Bernoulli Cartridges, Magcards.

Quality Media
Quickest turnaround
Guaranteed Satisfaction

COMPANY COMPENDIA, INC.
1-800-374-DISK
Ph: 312-419-8771 Fax: 312-419-1390

CIRCLE 598 ON READER SERVICE CARD

Software Duplication

ECHO

- DESIGN
- PACKAGING AND ASSEMBLY
- FULFILLMENT
- FAST QUOTATIONS
- 24 HOUR SERVICE

1-800-533-4188

Echo Data Services, Inc.
in PA call (215) 363-2400
SINCE 1983 MEMBER

CIRCLE 599 ON READER SERVICE CARD

FREE SOFTWARE

Receive 3.5 or 5.5.25" disks. Pay a service charge of only $2.95 per collection. Credit cards only.

- Kids
- Fonts
- Games
- Clip Art
- Windows®
- Home & Business

Software of the Month Club®
619-931-8111 Ext. 511
Satisfaction Guaranteed Since 1985

CIRCLE 594 ON READER SERVICE CARD

DATA CONVERSIONS

Free Test - Fast Service
(800) 833-2207

Disk - Tapes Scanning

Cartridges Fiche - Film

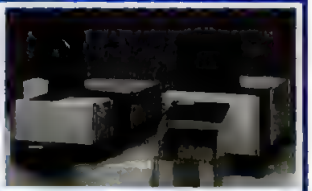
1ST RUN Computer Services Inc.
(212) 779-0800

SOFTWARE DUPLICATION

- Disks & Tapes
- Package Design
- Packaging & Assembly
- Printing
- Fullfillment
- Inbound Tele-Sales

EQUIPMENT

- Disk Duplicators
- Labeler Printers
- Sleevers
- Leasing
- Maintenance



Rimage Distributor

MEGAsoft
(800) 222-0490
FAX:(908)462-5658
819 Hwy. 33 E.
Freehold, NJ 07728

CIRCLE 600 ON READER SERVICE CARD

SOFTWARE LABS

WORLD'S LARGEST SHAREWARE DISTRIBUTOR

Selected by **IBM** as a supplier for software testing.

See why **IBM** chose our professionally tested virus-free library

IBM'S FREE

Call TOLL FREE or write for our free world famous 92-page catalog with exclusive 12 BONUS DISK offer.

100 CORPORATE POINTE, SUITE 195
CULVER CITY, CA 90231

800-569-7900
FAX: 310-410-2044

CIRCLE 595 ON READER SERVICE CARD

DUPLICATION FROM $.54

HIGHEST QUALITY MEDIA

MS DOS duplication from **$.54** (5.25") and **$.88** (3.5"). Prices go even lower as you continue to order!

- Duplication + 100% Verification
- Custom Labels/Sleeves/Mailers
- Custom Packaging & Assembly
- Colored Media Available
- Special Rates For Demo Software & Site Licensing
- Educational Discounts Available
- 24 Hour Turn-Around
- Guaranteed Products

800-255-3142
Diversified Systems Group, Inc.
PO Box 1114, Issaquah WA 98027

CIRCLE 597 ON READER SERVICE CARD

DATA CONVERSION

If you want the most complete conversion services in the industry, just call...

(800) CONVERT

Capabilities include over 3000 formats

PIVAR COMPUTING SERVICES, inc.®
165 Arlington Heights Rd. #M
Buffalo Grove, IL 60089
(708) 459-6010

Ontrack
DATA RECOVERY

- PROFESSIONAL SERVICE - AUTHORIZED by Conner, Seagate, Quantum, Maxtor, Apple, Rodime, Western Digital, and Micropolis
- EXPERTISE in virtually every operating system and media storage device - including tape backups!
- 24-HOUR SUPPORT with weekend, priority, and on-site service available
- FOR FAST, SUCCESSFUL RESULTS call Ontrack, we can recover your data!

MN: 1-800-872-2599 • CA: 1-800-752-7557

U.K: 0800-24 39 96 • 44-81-974 5522

2400 Main Street, Suite 200, Irvine, CA 92714 • 6321 Bury Drive, Eden Prairie, MN 55346

FORMATTED DISKETTES

5¼" 360K ..... 35 ¢	3½" 720K ..... 55 ¢
5¼" 1.2mg ..... 46 ¢	3½" 1.4mg ..... 87 ¢

BULK TAPES

2000 ..... $12.60	2120 ..... $16.00
6150 ..... $17.60	6320 ..... $22.50
4mm 1.3Gb ... $13.00	8mm 2.3Gb ... $12.80

SONY ◆ VERBATIM ◆ BASF
ALSO AVAILABLE

Price per disk in lots of 300
Subtract $.04 for unformatted DD. Subtract $.09 for unformatted HD.
Tapes in lots of 10. Mix and match any format or size.

VISA MEGAsoft MasterCard

(800) 222 -0490

FAX.(908)462-5658 • 819 Hwy. 33E. • Freehold, NJ 07728

CIRCLE 605 ON READER SERVICE CARD

DATA CONVERSION

DISKS • TAPES • CARTRIDGES
CONVERSION-DUPLICATION-SCANNING
MORE FORMATS THAN ANYONE !

Quick • Reliable • Quality

WORD PROCESSORS, MINIS
MICROS, SPREADSHEETS
DATABASES, MAIL LISTS
IBM, DEC, APPLE, WANG
HP, WordPerfect, MS-Word
Lotus
Dbase
MICOM
LANIER
CPT, NBI
DISPLAYWRITER
8/4MM, XEROX, CP/M, UNIX ...

NATIONAL DATA CONVERSION
5 East 16th Street, New York, NY 10003
(212) 463-7511
AMERICA'S LEADERS IN DATA CONVERSION

CIRCLE 001 ON READER SERVICE CARD

FORMATTED DISKETTES
BASF, VERBATIM, SONY

WITH FORMAT	QTY 250 MIX & MATCH	WITHOUT FORMAT
$.41	5.25" DS/DD	$.36
$.62	5.25" DS/HD	$.54
$.63	3.50" DS/DD	$.53
$.99	3.50" DS/HD	$.89

- FREE FORMATTING on first order
- TYVEC SLEEVES & Labels Included
- COLORED MEDIA Please Add $.05
- VOLUME DISCOUNTS Available
- SAME DAY Shipping
- MONEY BACK GUARANTEE

800-255-3142

Diversified Systems Group, Inc.
PO Box 1114, Issaquah, WA 98027

CIRCLE 603 ON READER SERVICE CARD

BUY A BETTER BULK DISKETTE
NAME BRAND BULK

		100 QTY
VERBATIM	5.25 DS/DD	.28¢
	5.25 HD	.52¢
SONY	3.5 DS/DD	.50¢
	3.5 HD	$1.09
GENERIC 100% GUARANTEED	5.25 DS/DD	.24¢
	5.25 HD	.38¢
	3.5 DS/DD	.39¢
	3.5 HD	.79¢

800-356-2553
FAX (404) 952-1432
media source

CIRCLE 606 ON READER SERVICE CARD

BULK DISKS
SONY◆ DYSAN◆VERBATIM

	QTY 250 BLANK	FORMATTED
$1/4" DS/DD	.33	.39
$1/4" DS/HD	.42	.54
31/2" DS/DD	.53	.68
31/2" DS/HD	.86	1.05

$1/4" INCLUDE SLEEVES/24 HOUR SHIPPING

800-426-0247

We also sell and service duplication equipment and disk duplication services.

PRINCETON DISKETTE
1101 Richmond Ave., Ft. Pleasant Bch., NJ 08742

CIRCLE 608 ON READER SERVICE CARD

SOFTWARE DUPLICATION

- ◆Highest Quality Media
- ◆Competitive Pricing
- ◆24 Hour Turnaround
- ◆Total Quality Assurance
- ◆Custom Labels & Packaging
- ◆Excellent Service

We Also Sell & Service Duplication Equipment

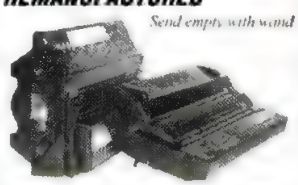
PRINCETON DISKETTE
800 426-0247
1101 RICHMOND AVE.◆FT. PLEASANT BCH., NJ 08742

CIRCLE 602 ON READER SERVICE CARD

TONER CARTRIDGES REMANUFACTURED

PRICES FROM $45 SHIP INCL.

Send empty with card



TESTED - GUARANTEED - 24-HR TURN

HP, Apple, Canon, IBM, etc. Laser Cartridges
Canon/Sharp-Z/Xerox Drum Copier Cartridges

MICR Toner, Fonts, Software for Laser Check Printing
Color Toners for Canon and IBM engines
OPC Cartridges and Toner for almost all laser printers

1-800-239-4027
1-800-722-2804 (Atlanta)

ADVANTAGE LASER PRODUCTS, INC.
1929 Queen City Ave. Tuscaloosa, AL 35401
2030 Powers Ferry Rd STE 218 Atlanta, GA 30339

CIRCLE 604 ON READER SERVICE CARD

STOP THROWING AWAY

TONER CARTRIDGES

Empty Cartridges Recycled
Guaranteed To Work Like New

From **$36**

FREE U.P.S. PICK-UP & DELIVERY

National Toner
Recycling & Supply
(800) 676-0749

CIRCLE 607 ON READER SERVICE CARD

NEARLY 9 OUT OF 10 PC MAGAZINE SUBSCRIBERS HAVE PURCHASED DIRECT IN THE PAST YEAR, AVERAGING ONE DIRECT PURCHASE EVERY MONTH.

For more information on how you can advertise to these direct buyers, call your PC Magazine Marketplace account representative today at:

[redacted]

Source: PC Magazine Direct Market Subscriber Study 1992

Sexy Software™ SEXY DISKS™

Sexcapades™ . . . The GAME

The First Adult Game with TRUE SOUND and 256 Color VGA Graphics

The game everyone has been waiting for. For that evening you won't forget with a loved one or group of very close friends. Fulfill your sexual desires. Find out how your partner would really like to make love. 1 Over 80 Color VGA Scenes • Real Voices Guide the Action • Foreplay Option • Play with 2-8 Close Friends

$79 – Special Offer **$69** with purchase of any CC disk. / VGA and hard disk required - shipped on high density disks

CONNOISSEUR COLLECTION ALL NEW! In 256 Color VGA!!

Sexy Disk #CC1 • ★ **YOU BE THE STAR** ★ The FIRST CUSTOMIZABLE movie allows you to write the dialog and the title. ONLY AVAILABLE FROM US!

Sexy Disk #CC2 • **THE FIRST SOUND MOVIE!** The first computer movie with SOUND. See the incredible 256 color VGA graphics while hearing the actual dialog. OURS EXCLUSIVELY!

Sexy Disk #CC3 • **THE BEST MOVIE!** The best computer movie available. Only for the serious collector. 256 stunning VGA colors.

Sexy Disk #CC4 • **VOLUPTUOUS MOVIE with Sound!** See and hear a symphony of exceptionally proportioned women.

Sexy Disk #CC5 • **ODDITIES MOVIE with Sound!** See men of incredible proportions and women with unique abilities - UNBELIEVABLE!

Prices: *1 Movie* **$29**. *3 Movies* **$65**. *5 Movies* **$94**

Sexy Graphics with SOUND!

Our EXCLUSIVE 256 color VGA graphics TALK and PLAY MUSIC through your standard speaker.

SG10– Top Heavy Mamo disk - extremely amply endowed women TALK to you while you admire their HUGE proportions. SIZZLING!

SG11– Encounter disk - we can't describe the explicit action you will see and HEAR - absolutely INCREDIBLE!

SG12– Swimsuit Disk - You will see the sexiest swimsuits while the girls TALK to you about their turn-ons and turn-offs.

SG13– Science Fiction Disk - You will see incredible space shots and alien encounters while hearing other-worldly descriptions and music.

Each disk is over 1.2MB - plus **FREE DISK** with over 2.5MB of utilities for printing, cataloging, converting to WINDOWS WALLPAPER, and changing the pictures. Req. VGA with 512K

Prices: *One disk* **$19**, *2 disks* **$35**, *3 disks* **$49**, *4 disks* **$59**

ORIGINAL Sexy DISKS – 6 disk set with movies, pictures, games $32

ADD $4 S/H • 3.5" Or FOREIGN ORDERS ADD $2/DISK • IN PA ADD TAX • MUST STATE AGE OVER 21 YEARS

VISA/MC Orders Only: 800-243-1515 Ext. 600CN / 24 HRS / 7 DAYS

Or CK/MO to: Sexy Software, P.O. Box 220, Dept. 600CN, Hatfield, PA 19440

Sexy Software™ SEXY CD-ROMS™

Sexcapades™ . . . The MOVIE

First 600MB Movie for the PC

The most incredible NEW CD ROM Product! The FIRST complete 600 MB MOVIE with SOUND for the IBM PC. The movie features a group of friends playing our Sexcapades game. The action is hot and incredible! You will see unbelievable uses of a mouse and joystick. This beautiful 256 color VGA movie fills 3/4 of the screen. You will need at least a 386SX computer; you can pause & Scan as on a VCR. OURS EXCLUSIVELY!

Price $129 or **$99** with any other CD-ROM purchase. Sexcapades game **50% OFF** with movie purchase

Sexy CD-ROMS

Sexy CD #1 the premiere adult collection - 680 MB of action with 5268 VGA pictures, 87 movies, 674 stories, games, DARE TO COMPARE!

Sexy CD #2 an exclusive collection containing over 900 Super VGA pictures (1024 x 768 x 256) and over 400 VGA pictures (640 x 480 x 256). These are pictures that cannot be found anywhere else! The women and the quality are stunning.

Sexy CD #3 another collection of over 650 MB of the hottest pictures available. Over 5,000 VGA pictures, movies and utilities that will have you spending days just trying to see it all!

MENU DRIVEN VIEWING - NO DUPLICATION | PRICE: $99 each ($95 with any CD disk or Sexcapades) - **SUPER CD BUNDLE** - TAKE ALL 3 Adult CD ROMS FOR **$199**

MIX & MATCH CD-ROMS

First 3: $99 each or 3 for $199; Then: $69 each or 3 for $149

ADULT TITLES
MY PRIVATE COLLECTION
PC PIX
EROTICA
SO MUCH SHAREWARE
EXTREME
ANIMATION FANTASIES

COMMERCIAL TITLES
National Geographic Multimedia Mammals, Automap and Atlas
Phoenix Shareware - 4,000+ programs, menu driven
Sherlock Holmes Consulting Detective
Magnum Sight and Sound - sounds, pictures, stories
Chessmaster 3000 - chess with sound
So Much Shareware - 500 Multivalent pictures, viewers
So Much Shareware - Over 1 GB/business, graphics, games
Windows CD - 1500 files, fonts, icons etc.
Grolier's Multimedia Encyclopedia - sounds on 2 CD ROMS

380ms Internal Drive Kit - $249 (with 3 CD purchase)

CIRCLE 609 ON READER SERVICE CARD

Where Adults Come To Play!

ODYSSEY

Discover The BBS That America Is Talking About!

- A Local Call From 800 Cities Worldwide!
- CHAT Live With Thousands of Users in Groups and Private!
- Live Tournament Gaming!
- Giant Message Exchanges!
- Thousands of Shareware & GIF Files!
- Online Shopping/Travel/Reservations!
- Matchmaker With "DATING-BASE"!
- Special Women's Groups!
- Plus Much Much More!

For Modem Signup or More Info Call

818-358-6968

Must Be Over 18 (8N1)

CIRCLE 610 ON READER SERVICE CARD

San Francisco's Premier Adult Gay Men's Online Service has NOW gone Nationwide!

- Local access from over 1,000 US cities!
- Live uncensored group & private chat!
- Online, interactive, multi-player games!
- Lively salon style public forums!
- Over 20,000 XXX rated GIFS & files!
- MatchMaker online databases!
- 50+ lines available 24 hours a day!
- Gay owned and operated, your privacy assured!
- *Much, much more!*

For your local access number, information, & signup, CALL:

(415) 703-8200

Set modem to 8/N/1. You must be 18 or older.

Finally...a national adult Gay men's BBS!

EYE CONTACT

CIRCLE 612 ON READER SERVICE CARD

FREE ACCESS

Never a charge! Never a charge!

Dial into America's newest and hottest BBS.

Totally unbeatable one-on-one and partyline action.

62 lines!
Major BBS V6.0
Exciting graphics and the best downloads anywhere.

Also mega shareware files, multi-user games, sizzling gif files and hot message forms.

Make your modem smoke! Call Now!

1-715-758-1000

EROS

COMES ALIVE ON YOUR PC OR MAC!

Experience EROSLink The Ultimate Online Service

- Uninhibited one-on-one chat and party lines with exciting hostesses and callers
- Sensuous color publication-quality images for downloading

Act Today! Get your software and information on how to access EROSLink in your area—

Use your modem (8-N-1) to dial:

1-212-254-0969

CIRCLE 611 ON READER SERVICE CARD

BodyCello

Adults Only Must be 18 or older to order

3.5" Floppy Disk — 25 color pictures, image viewer free w/1st order, #888

#3-10 Sampler - beautiful models.....$39.95
#3-17 Down Unders - photos.....$39.95
#3-13 Exotica - exotic art.....$39.95

200 images in 24-bit color. Picture viewer. CD-ROM

#3-46 Swimsuit - photos.....$199.00
#3-43 ExoticaROM 3.0 - exotic art.....$199.00
#3-41 Heavenly Bodies v.2 - photos.....$199.00

Color Catalog — FREE color uncensored catalog w/purchase

Or send $5.00 for your catalog to: BodyCello
P.O. Box 910531, Sorrento Valley, CA 92191

Dealer Inquiries Welcome **1-800-922-3556**

Intnl: 619-578-6969 • FAX: 619-536-2397 • Include $4.75 for s/h • Foreign add $15 s/h • CA. res. add sales tax

CIRCLE 613 ON READER SERVICE CARD

Censored !

Sorry . . . we wanted to show you a sample photo, but they wouldn't let us. So. . .

Would you like to see gorgeous Centerfold Models appear on your computer? Or do you prefer Amateur girl-next-door types who have a Body to die for, in Sexy Swimwear, revealing Lingerie or Very Explicit Nude poses? Maybe together in Love Sets?

Catalog: Over 4,500 images are available and we show you 500 sample color photos in our 70 page catalog - $5.00. Look before you buy. CD-ROM and VGA MOVIES too!

Samples: See the quality of our images by ordering Demo Set #1 or #2. Each Demo Set has 25 different GIF images. Each Demo Set is only $29.95 (+ $4.75 p/h). Catalog is Free with purchase of Demo Set.

Save $10.00: Order Demo Set #1 and #2 and see 50 different models for only $49.95 (plus $5.00 s/h). You save $10.00.

Order: Call (818) 993-5629 Visa/MasterCard accepted. To order by mail, send cash, check, money order or credit card info to: Centerfolds on Disk ("CoD")
P.O. Box 5138, Chatsworth, CA 91313-5138

Must be 21 years of age or older to order

CIRCLE 614 ON READER SERVICE CARD

It's A Jungle Out There!

But PC Magazine Classified Delivers The Lion's Share of the Market.

PC Magazine makes selling easier by delivering responsive direct buyers twice monthly.

PC Magazine ads trigger immediate response and direct sales.

After reading an ad in PC Magazine...

- ***60% of PC Magazine subscribers buy direct***
- ***55% of PC Magazine subscribers write/phone company for product information***
- ***47% of PC Magazine subscribers recommend the product to someone else***

With a response like this, your business will do more than just survive!

Call your PC Magazine Marketplace account representative today at:

1-800-825-4237

STARWARE CD-ROMS

Purchaser must state age over 21

So you're interested in Adult CD-ROMs - but with so many to choose from, how do you know which CDs are right for you? Now, the Starware Adult Bundles make ordering easy. Each Bundle has been carefully selected to include only the BEST Adult CD-ROMs. So just pick the Bundle that best fits your computer expertise and interest. To get you viewing pictures in a hurry, we have included our "Quick Start Instructions" with each Bundle. You are guaranteed the best CD-ROMs at an UNBEATABLE PRICE!

Bundle #1 ..... **"For Beginners"** ..... **$160 value** ..... **ONLY $118**
Instantly add thousands of GIF files and hundreds of movies to your computer erotica collection. Novice computer users will truly enjoy this hassle-free 2-disc set. These discs will work with any VGA computer and will always have an easy-to-use menu. **Includes Private Pictures and So Much Starware.*

Bundle #2 ..... **"Super VGA Users"** ..... **$300 value** ..... **ONLY $198**
Super VGA users will be delighted with this special 3-disc set. This bundle is the largest adult collection of 1024x768 and 800x600 256 color GIF images. Computers equipped with 1 MB Super VGA adapters are highly recommended. **Includes Volcano, Smutware and PCPIX 2.*

Bundle #3 ..... **"Lights, Camera, Action"** ..... **$300 value** ..... **ONLY $198**
Movie buffs will love these 3 CD-ROMs featuring the latest and greatest adult movies for your PC. Each disc has hundreds of the best multimedia, computer animation and video clip creations for mature computer users. 386- or 486-based computer is recommended. **Includes Ecstasy, Storm 3 and Animation Fantasies 2.*

Bundle #4 ..... **"Not for Cable TV"** ..... **$300 value** ..... **ONLY $198**
Depending on your taste in adult material, this is either the worst or the best collection of 3 adult CD-ROMs. If you are timid or only curious about adult material, *DO NOT* get this bundle. A "diverse" group of subject matter is explored on these discs. This bundle contains the most explicit GIF files and movies you'll find on CD-ROM. **Includes GBL (Gay, Bi, Lesbian), Busty Babes and Erotic Encounters.*

As our thanks for purchasing bundles 2, 3 or 4 we invite you to select either additional bundle for only $148!

Contents of Bundles are subject to change* **Always the Latest Titles

24 Hr. Hotline 800 354-5353

Voice 305 426-4352 FAX 305 428-8681 BBS 305 428-0012

Send Check/Money Order:
Starware Publishing Corp.
PO Box 4188, Dept. 69
Deerfield Beach, FL 33442

Florida residents add 6% sales tax

$4.00 Shipping & Handling
$7.00 2-day
$15.00 Next day
$22.00 Foreign Express

CIRCLE 815 ON READER SERVICE CARD

It's A Jungle Out There!

But PC Magazine Classified Delivers The Lion's Share of the Market.

PC Magazine makes selling easier by delivering responsive direct buyers twice monthly.

PC Magazine ads trigger immediate response and direct sales.

After reading an ad in PC Magazine...

- ***60% of PC Magazine subscribers buy direct***
- ***55% of PC Magazine subscribers write/phone company for product information***
- ***47% of PC Magazine subscribers recommend the product to someone else***

PC MAGAZINE

With response like this, your business will do more than just survive!

Call your PC Magazine Marketplace account representative today at:

1-800-825-4237

Source: PC Magazine Direct Market Subscriber Study, 1992 (past 12 months)

FREE!

Download the HOTTEST & SEXIEST images from our ADULT On-Line Magazine - FREE!

LACE **is an Adult On-Line Magazine that offers you:**

- **ORIGINAL** Adult GIF Images not available on any other BBS!
- **GORGEOUS,** Sexy & Exotic Models both Amateur and Professional !
- **QUALITY** Adult GIF Images and VGA Movies produced by professionals !
- **HIGH SPEED** access available on ALL lines (14.4k down to 1200 baud).

Set your Modem to 8-N-1 and dial:

(818) 709 - 4275

Questions? Call our voice line at (818) 709-3795.

LACE

the on-line adult magazine

Must be 18 Years of Age or Older • Limited Offer

CIRCLE 616 ON READER SERVICE CARD

THE NEW PC MAGAZINE CLASSIFIED FORMAT GIVES YOU MORE FOR FAR LESS...

- New flexible ad sizes
- More color options
- Lower cost-per-inch

Call your PC Magazine MarketPlace account representative today at 1•800•825•4237 and let the new Classified work for you.

1-800-825-4237

CLASSIFIED

COMPUTER IMAGES

Use toll-free 800 # to sign up with credit card. Once verified use same 800 # to download files.

1-800-GO-MODEM

Or use direct dial 64 Line BBS at (503) 697-5100 8/N1

Super VGA 1024x768x256

ASTRONOMY
HUGE ADULT AREA
SCENIC * GRASP ANIMATOR
3D* STUDIO MOVIES
SOUND * GAMES
UTILITIES * IMAGE CONVERTERS

Event Horizons Commercial BBS, thousands of images and movies. Must be 21 to download from adult areas. Quality Color SuperVGA/EGA. 1200/2400 bps $12/hr., 9600 bps $48 hr., 800# $6/hr. extra. Also Professional Image Scanning from prints or slides to disk.

No Modem? Order our Mail Image Library with samples $9. Worldwide shipment. Info voice line 503-697-7700. All credit cards accepted. Same day shipment.

If you would like to talk to our female models live, call:

1-800-466-9800

24 hours a day, 7 days a week. Have your credit card ready.

EVENT HORIZONS

311 Ave. B, Ste. 209
Lake Oswego, OR 97034
Voice 503-697-7700, BBS 800-466-6336, or BBS 503-697-5100

CIRCLE 617 ON READER SERVICE CARD

PC MAGAZINE MARKETPLACE BUSINESSCARD

PC Magazine's BusinessCard section is a forum for innovative, hard-to-find and low-cost PC products and services. Ads are listed by product category and include Reader Service numbers to allow fast, easy response.

RATES:
1 issue–$715, 3 issues–$625, 6 issues–$605, 12 issues–$570, 17 issues–$545, 22 issues–$535. Multiple-ad per issue rates also available. Prepayment must accompany each insertion. VISA/MC welcomed.

AD FORMAT:
PC Magazine will design and typeset each BusinessCard ad. Advertisers should furnish typewritten copy. Ads include: 1) Headline (1 line, initial caps=30 characters max, all caps=25 characters max), 2) Descriptive copy (5 lines, 225 characters max), 3) Company name (same specifications as headline), and 4) Address and telephone number (2 lines, 40 characters per line). No logos, artwork or camera-ready ads. Publisher reserves the right to edit supplied copy to meet section specifications.

DEADLINES:
PC Magazine is published 22 times a year, (bimonthly except for July and August). The BusinessCard closing is approximately two months prior to issue date. Please send copy and payment to:

PC Magazine BusinessCard
One Park Avenue, 3rd Floor
New York, NY 10016
For more information, call 800-825-4237 *or* 212-503-5115, FAX: 212-503-5860.

ADD-IN BOARDS

LEARN PARALLEL PROCESSING
- Transputer Education Kit
- PC add-in board with transputer & 1MB mem
- T400 C & Occam2 compilers & debuggers
- 1500 pages of documentation with schematics
- Only $396 Visa-MC-A/X accepted

Computer System Architects
15 North 100 East, #100, Provo, UT 84606-3100
(801) 374-2300 • (800) 753-4CSA

CIRCLE 701 ON READER SERVICE CARD

WALNUT CREEK CDROM
Simtel20: 6000+MS-DOS programs. $24.95
CICA: all sorts of MS Windows stuff $24.95
Source: 600+megs. C, pascal, etc. $39.95
MC/Visa. Money back guarantee (510) 947-5996

WALNUT CREEK CDROM
1547 Palos Verdes, Walnut Creek, CA 94596
1 (800) 786-9907 Fax: 1 (510) 947-1644

CIRCLE 706 ON READER SERVICE CARD

IBM, MAC, H.P. EVEREX
•HOT NEW PRODUCTS • SERVICE WITH INTEGRITY
•ROCK SOLID RELIABILITY: Omnibus is known the world over for computers and peripherals:
• COMPAQ • NETWORKING • IBM COMPATIBLES.
M/C, VISA

Omnibus Computers Inc.
1933 Davis Street #296, San Leandro, CA 94577
Tel: 510-430-2706 Fax: 510-430-2709

CIRCLE 711 ON READER SERVICE CARD

CD-ROM

CD-ROM CADDIES
Protect your disc from fingerprints, dust & scratches. Professional Quality, Industry Standard. Official Licensed Product - Made in USA. Also in stock: CD-ROM STORAGE UNITS, DISK CLEANERS, LASER LENS CLEANERS. Dealer Programs avail. Visa/MC.

QB PRODUCTS
1260 Karl Ct. Wauconda, IL 60084
Phone: 800-323-6856 Fax: 708-487-2689

CIRCLE 702 ON READER SERVICE CARD

WIN $200 Billion Gov't Marketplace
On BID-DISC Weekly CD-ROM. Entire Commerce Business Daily indexed on Folio software. Special:$49 Panasonic CD-ROM drive with 1 yr. subscription • 5 weeks trial $49 •1 year $950. Offer expires 5/31/93. VISA/MC/PO's

Panatech Corporation
PO Box 18456, Huntsville, AL 35804
800-766-5824•205-533-5476 Fax:205-881-3448

CIRCLE 707 ON READER SERVICE CARD

LAPTOP/PORTABLES

PORTABLE COMPUTER BATTERIES
Replacement batteries for over 150 portable computer makes and models. No computer too old or new. In stock, Immediate shipment. Credit cards accepted. FREE CATALOGUE.

Penguin Portables
CALL 1-800-241-1096

CIRCLE 712 ON READER SERVICE CARD

CD-ROM WAREHOUSE
NIGHT OWL 7.0-$54.95, LOOM -$44.95 Phoenix 3.0-650megs Over 7500 files-$39.95 Moving Fantasies-Brand New! Adults ONLY!-just $59.95-call for details!!! 100's of other low priced titles available. FREE Catalog! V/MC/AmEx.

CD-ROM WAREHOUSE
1355 W. Palmetto Pk Rd. Ste 348, Boca Raton, FL 33486. Tel:800-344-2599.

CIRCLE 703 ON READER SERVICE CARD

CD PowerBox $49.95 +$5 S&H
6800+ files on this 621 Meg CD-ROM. 100% shareware! Use our GUI to easily find and install files to your HD. FILES.BBS included for all 50 areas to make the CD PowerBox BBS ready. Dealer Inquiries Welcome! VISA/MC

Damar Enterprises
P.O. Box 31552, Mesa, AZ 85275-1552
Tel: (510) 866-6141 ext. 130

CIRCLE 708 ON READER SERVICE CARD

SOFTWARE: ACCOUNTING

THE EASIEST OF THEM ALL™
Full featured FoxPro based Integrated Accounting for PC's. Faster, More Complete and Easier to Use, See PC Magazine May 12, 1992. Only $295.00 Call for free info kit, demo disk and upgrade offer.

PC ACCOUNTANT™
P.O.Box 2278, Kirkland, WA 98083
800-827-1303 206 827-4361

CIRCLE 713 ON READER SERVICE CARD

FREE CD-ROM DISCOUNT CATALOG!
Hundreds of discounted CD-ROM titles, from $8 up. Call or write for your free catalog.

Ellis Enterprises, Inc.
4205 McAuley #385, Oklahoma City, OK 73120
1-800-729-9500

CIRCLE 704 ON READER SERVICE CARD

COMMUNICATIONS/NETWORKING

KEYBOARD, VIDEO, MOUSE
EXTENSION with EXTENDER
SPLITTING with COMPANION
SWITCHING with COMMANDER
Boosts SIGNALS UP to 600 FT. Control Up to 96PC's with one KEYBOARD and MONITOR.

CYBEX CORPORATION
2800H Bob Wallace Ave., Huntsville, AL 35805
PHONE 205-534-0011 FAX 205-534-0010

CIRCLE 709 ON READER SERVICE CARD

BUSINESS

BlankCheck - Now for Quicken®
Use 1 blank form and print checks for up to 300 checking accounts on your HP laser printer using your Quicken software & our BlankCheck kit. Supports voucher,standard, & wallet checks. Complete kit with software, MICR toner & forms only $799.

SouthData, Inc.
PO Box 1703, Mt. Airy, NC 27030 800-628-7227
In Canada: Capriole Software 416/288-1266

CIRCLE 714 ON READER SERVICE CARD

NIGHT OWL'S Shareware CD's
650meg, about 10,000 files, zipped, non Adult w/retrieval, also set-up for PcBoard/RA. v8/v7 US$60 $C75 ea, v6.1/v5/v4.2 US$50 $C63 ea deliv. Cda+GST/OPST. Check/Visa. Outside NA + $10 deliv. Visa bill in $C at approx exchange

Integrated Data Systems
120 27th St #3, Etobicoke, ON CDA M8W 2X7
(416) 252-1132 voice/fax 416-252-1133 BBS

CIRCLE 705 ON READER SERVICE CARD

COMPUTER SYSTEMS

386/486 BLOWOUT PRICES
386-40:$1109,486SX-25:$1199,486DX-33-$1379
486DX-50: $1599 486DX2-66: $1739
4MB RAM, 1.2 & 1.44FD, 120MB HD, SVGA .28, KB101, SVGA w/1M, 2S1P1G, Mouse 1 Yr. Wrnty. OPT CD ROM $199. VESA LOCAL BUS AVAILABLE

ONE STEP AHEAD SYSTEMS
P.O. Box 832482, Richardson, TX 75080
(800) 886-0808 FAX (214) 234-3478

CIRCLE 710 ON READER SERVICE CARD

MARKETING POWER
Is yours when you place your message in this space. Reach 786,000+ buyers of all kinds of PC products. Give your business card PC Magazine Marketplace Power.

BusinessCard
Call 1-800-825-4237 today.

CIRCLE 715 ON READER SERVICE CARD

READER SERVICE CARD FREE INFORMATION

IT'S AS EASY AS 1, 2, 3

1. Fill in your name and address and check off your answers to the nine research questions
2. Circle the numbers on the card that correspond to the ads or articles you'd like more information about
3. The literature will be mailed to you from the advertiser free of charge

CIRCLE FOR FREE INFORMATION

Void after July 31, 1993

001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 021 022 023 024 025 026 027 028 029 030 031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 047 048 049 050
051 052 053 054 055 056 057 058 059 060 061 062 063 064 065 066 067 068 069 070 071 072 073 074 075 076 077 078 079 080 081 082 083 084 085 086 087 088 089 090 091 092 093 094 095 096 097 098 099 100
101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200
201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250
251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300
301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350
351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400
401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450
451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500
501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550
551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600
601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650
651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700
701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750
751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800
801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850
851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900
901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950
951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999

1. Do you work in a DP/MIS dept.?
01 ☐ Yes 02 ☐ No

2. Please indicate your company's or organization's primary business activity: (Check one only.)
01. ☐ Manufacturer Computer Equip., Computers, Software
02 ☐ Manufacturer–Aerospace
03. ☐ Manufacturer–Other
04. ☐ Systems House
05. ☐ Computer Consultant
06. ☐ Computer Retailer/VAR/VAD Distributor
07 ☐ Communications
08 ☐ Finance/Banking/Insurance/ Real Estate/Accounting
09. ☐ Education
10. ☐ Government–Federal
11. ☐ Government–Non-Federal
12 ☐ Research and Development
13. ☐ Data Processing/Computer Service
14 ☐ Health/Medical/Legal Service
15 ☐ Engineering/Architecture
16. ☐ Agriculture/Construction/ Mining/Oil/Transportation/ Utilities
17 ☐ Non-Computer Retailer/Distributor
18. ☐ Other Business or Service

3. Please indicate your primary business function: (Check one only.)
01. ☐ DP/MIS
02. ☐ Systems, Programming
03. ☐ Communications
04. ☐ Engineering
05. ☐ Res./Dev./Scientific
06. ☐ Accounting/Finance
07. ☐ Computer Consulting
08. ☐ Purchasing
09. ☐ Operations
10. ☐ Production
11 ☐ Education/Training
12 ☐ Marketing/Sales
13. ☐ Medical/Legal
14. ☐ Admin./Mgmt.
99. ☐ Other

4. Is your company a reseller?
01 ☐ Yes 02 ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:
01. ☐ 10 or less 03. ☐ 26-99
02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office? (Check all that apply.)
01. ☐ Linked to mainframe
02. ☐ Linked to mini
03 ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply.)
01. ☐ IBM or Compatible PCs
02. ☐ IBM or Compatible Mainframes
03. ☐ IBM or Compatible Minis
04. ☐ Macintosh
05. ☐ CD-ROM
06 ☐ Windows

8. Do you plan to buy any PC products?
01. ☐ Now 03. ☐ In 7 to 12 months
02 ☐ In 4 to 6 months 04 ☐ No definite plans

9. Number of Employees in your entire company:
01 ☐ 25 or less 02 ☐ 26-99 03 ☐ 100-499 04. ☐ 500-999 05 ☐ 1000 or more

PLEASE PRINT CLEARLY PC 3/30-6

Name

Title | Telephone

Company Name

Address

City | State | Zip

☐ Please send me one year (22 issues) of PC Magazine for $29.97 Offer valid in U.S. only

Free Product Information

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 433 RIVERTON, NJ

POSTAGE WILL BE PAID BY ADDRESSEE

PC MAGAZINE

P.O. Box 1687
RIVERTON, NJ 08077-9687

Free Product Information

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS MAIL PERMIT NO. 433 RIVERTON, NJ

POSTAGE WILL BE PAID BY ADDRESSEE

PC MAGAZINE

P.O. Box 1687
RIVERTON, NJ 08077-9687

PC MAGAZINE **READER SERVICE CARD FREE INFORMATION**

IT'S AS EASY AS 1, 2, 3

1 Fill in your name and address and check off your answers to the nine research questions

2 Circle the numbers on the card that correspond to the ads or articles you'd like more information about

3 The literature will be mailed to you from the advertiser free of charge

CIRCLE FOR FREE INFORMATION

Void after July 31, 1993

001 002 003 004 005 006 007 008 009 010 011 012 013 014 015 016 017 018 019 020 021 022 023 024 025 026 027 028 029 030 031 032 033 034 035 036 037 038 039 040 041 042 043 044 045 046 047 048 049 050
051 052 053 054 055 056 057 058 059 060 061 062 063 064 065 066 067 068 069 070 071 072 073 074 075 076 077 078 079 080 081 082 083 084 085 086 087 088 089 090 091 092 093 094 095 096 097 098 099 100
101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200
201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250
251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300
301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350
351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400
401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450
451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500
501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550
551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600
601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650
651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700
701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750
751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800
801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850
851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900
901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950
951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999

1. Do you work in a DP/MIS dept.?
01. ☐ Yes 02. ☐ No

2. Please indicate your company's or organization's primary business activity: (Check one only.)
01. ☐ Manufacturer Computer Equip., Computers, Software
02. ☐ Manufacturer–Aerospace
03. ☐ Manufacturer–Other
04. ☐ Systems House
05. ☐ Computer Consultant
06. ☐ Computer Retailer/VAR/VAD Distributor
07. ☐ Communications
08. ☐ Finance/Banking/Insurance/ Real Estate/Accounting
09. ☐ Education
10. ☐ Government–Federal
11. ☐ Government–Non-Federal
12. ☐ Research and Development
13. ☐ Data Processing/Computer Service
14. ☐ Health/Medical/Legal Service
15. ☐ Engineering/Architecture
16. ☐ Agriculture/Construction/ Mining/Oil/Transportation/ Utilities
17. ☐ Non-Computer Retailer/Distributor
18. ☐ Other Business or Service

3. Please indicate your primary business function: (Check one only.)
01. ☐ DP/MIS
02. ☐ Systems, Programming
03. ☐ Communications
04. ☐ Engineering
05. ☐ Res./Dev./Scientific
06. ☐ Accounting/Finance
07. ☐ Computer Consulting
08. ☐ Purchasing
09. ☐ Operations
10. ☐ Production
11. ☐ Education/Training
12. ☐ Marketing/Sales
13. ☐ Medical/Legal
14. ☐ Admin./Mgmt.
99. ☐ Other

4. Is your company a reseller?
01. ☐ Yes 02. ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:
01. ☐ 10 or less 03. ☐ 26-99
02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office? (Check all that apply.)
01. ☐ Linked to mainframe
02. ☐ Linked to mini
03. ☐ Networked together

7. Please check the equipment currently installed at your location: (Check all that apply.)
01. ☐ IBM or Compatible PCs
02. ☐ IBM or Compatible Mainframes
03. ☐ IBM or Compatible Minis
04. ☐ Macintosh
05. ☐ CD-ROM
06. ☐ Windows

8. Do you plan to buy any PC products?
01. ☐ Now 03. ☐ In 7 to 12 months
02. ☐ In 4 to 6 months 04. ☐ No definite plans

9. Number of Employees in your entire company:
01. ☐ 25 or less 02. ☐ 26-99 03. ☐ 100-499 04. ☐ 500-999 05. ☐ 1000 or more

PLEASE PRINT CLEARLY PC 3/30-6

Name

Title Telephone

Company Name

Address

City State Zip

☐ Please send me one year (22 issues) of PC Magazine for $29.97. Offer valid in U.S. only

PC MAGAZINE MARKETPLACE BUSINESSCARD

BUSINESS

INCREDIBLE OPPORTUNITY!
73 year old sole owner of 18 year Calif software firm needs associate with marketing talent and capital to expand. Nation's best programs for Maintenance, Energy Conservation, Utility Bills, etc Solid base of prominent, satisfied users.

The President, GETC
P.O. Box 2178, Newport Beach, CA 92663
Tel: 714/645-7733 Fax: 714/645-7747

CIRCLE 716 ON READER SERVICE CARD

Be More Productive — For Less!
Prisma Personal Productivity & Business Graphics software helps organize &manage your daily, weekly & monthly workload, & communicate your plans and ideas better. Prisma's products are powerful & reliable, yet priced low. Call for Free catalog today.

Prisma Software
401 Main Street • Cedar Falls, IA 50613
Phone: 1-800-437-2685 • Fax: 319-266-2522

CIRCLE 717 ON READER SERVICE CARD

COMMUNICATIONS/NETWORKING

FileWizard
Analyze NetWare server by user, volume, directory, and file extension, over time. Create action/archive strategies to fit your specific needs. Users retrieve archived files. Full range of Graphical analysis, printed reports & forecasting.

Knozall Systems, Inc.
375 E. Elliot Rd., Ste 10, Chandler, AZ 85225
800-333-8698 602-545-0006/Fax 545-0008

CIRCLE 718 ON READER SERVICE CARD

Voice Mail / Fax On Demand
Total HW/SW solution. Applications Generator. Multi-level tree configured/displayed on screen. Win 3.1. Background. Auto-Attend, Msg Center, FOD, Msg forwarding/paging, fax scanner, and much more. $595 SRP. Dealer Inq. welcomed.

Edens Technology Corp.
309 W. Beaufort, Suite 8, Normal, IL 61761
Tel(309)862-1704.Fax/F.O.D.Demo(309)862-1804

CIRCLE 719 ON READER SERVICE CARD

COMPUTER LANGUAGES

REXX AND NOVU

REXX/Windows™	$149.00
Portable/REXX for MS/DOS	$30.00
REXX4NT™	Call
Novu™ Colorful Windows editor	$30.00
SAA compatible No royalties	Visa/MC

Kilowatt Software
(800) 848-9474 Phone & FAX
(614) 866-4300 Phone & FAX

CIRCLE 722 ON READER SERVICE CARD

CONSTRUCTION

SERVICE MANAGEMENT SOFTWARE
Instant access to customer history. Automated dispatching. Timely billing. Take charge of your business with CMAS Plus, our integrated accounting/job costing/service management system for specialty contractors. Call for free demo.

DATA-BASICS, INC.
11000 Cedar Road•Cleveland, OH 44106
1-800-837-7574•Fax (216) 721-2398

CIRCLE 723 ON READER SERVICE CARD

DATA ANALYSIS

Advanced Data Analysis ... at a click!
CLICK-X™ software, the most user friendly data analysis - - - ever! • Edit Graph/Data • Analyze • Advanced Math / Regression / Engineering / Statistics • Import/Export. FREE demo disk. Custom software available.

SoloSoft
P.O. Box 2548, Stamford, CT 06906-0548
Phone: (203) 977-8161 Fax: (203) 977-8237

CIRCLE 724 ON READER SERVICE CARD

DATA BASE

dBASE file access from C, Basic,....
CodeBase 5.0 gives complete database management with multi-user dBASE, FoxPro or Clipper file compatibility from C, C++, or Visual Basic. Full 90 day money back guarantee. Order now for a FREE CodeReporter or call now for a FREE demo.

SEQUITER SOFTWARE
#209, 9644-54 Ave, Edmonton, AB, Can. T6E 5V1
Call (403) 437-2410, Fax (403) 436-2999

CIRCLE 725 ON READER SERVICE CARD

DATA ENTRY

INDSFILE•3164•VT100 for PC/Macs
File transfer, terminal emulation, remote takeover, script encryption •Trace facility •Scripting •Customizable Colors •User-definable keyboards •Dialing Directory •Full-Featured Demos. RCOM/MF for TSO, CICS, CMS, ICCF, DOS/BAT.

COMPUTER VECTORS, Inc.
74-5599 Luhia St., #E-7, Kailua-Kona, HI 96740
800-262-RCOM 808-329-6646

CIRCLE 720 ON READER SERVICE CARD

PC VOICE MAIL KIT $1795
• Voice Processing on your PC • Software and 4 line board included • Order Taking • AUDIOTEX • Voice Messaging • Never miss another call! • HUNDREDS OF USES • Don't pay $1,000's CALL TODAY FOR Free DETAILS • 2yr warranty

Amerifax Services Corp.
572 W. Market St. #5, Akron, OH 44303
(216) 253-8787 • (216) 762-6050 Demo

CIRCLE 721 ON READER SERVICE CARD

The Data Entry Emulator™
Full featured, heads-down data entry with two-pass verification, edit language, operator stats, batch control, output record reformat, on-line help, free tech support. From $395. LAN version available.

Computer Keyes
21929 Makah Road, Woodway, WA 98020
800-356-0203/206-776-6443/Fax:206-776-7210

VIKING DATA ENTRY SYSTEM
•Software for Data Entry Professionals
•Advanced Validations & Re-key Verify
•Used by U.S. Census & 26 of Fortune 50
•MS/DOS, UNIX, VMS, AIX Versions
•Free Preview Demo

Viking Software Services, Inc.
4808 E. 67th St., Tulsa, OK 74136
(800) 324-0595 FAX: (918) 494-2701

CIRCLE 727 ON READER SERVICE CARD

DIAGNOSTICS

"PINPOINT ANY PC FAILURE"
...says John Dvorak, PC Magazine 6/30/92. Top-rated PocketPOST Power-on Self Test card plus diagnostic software for ISA/EISA/Micro-Channel. 180-page manual. Hones your trouble shooting skills. CALL NOW

DATA DEPOT, INC
1710 Drew St #5, Clearwater, FL 34615
800-767-3424/813-446-3402 FAX:(813)443-4377

CIRCLE 728 ON READER SERVICE CARD

EDUCATION

Electrons to Microchips
A beginners' guide to electronics and microelectronics. Hundreds of diagrams, lots of animation. Four 5.25" disks or two 3.5" diskettes. Single user $199, multiple $399, (shipped free)... or send $5 for demo. VISA/MC.

MicaSOFT
45 Heol Frank, Swansea SA5 7AS, Great Britain.
Phone 44-792-584-388 Fax 44-792-581-052

CIRCLE 729 ON READER SERVICE CARD

ENGINEERING

SIMULATION
GPSS/PC™ is full-power version of the most popular mainframe simulation language, GPSS. Designed for interactive use on high-speed microprocessors, it has 6 graphics and animation windows. It predicts behavior of complex systems.

MINUTEMAN SOFTWARE
P.O. Box 171/B, Stow, MA 01775
800-223-1430/508-897-5662 Ext.316

CIRCLE 730 ON READER SERVICE CARD

ENTERTAINMENT/GAMES

Computer Screens That Sizzle!
The sexiest VGA Selections at Low, Low Prices. Freebies, Special offers & Instructions. Easy to Use & Fast Delivery. Must be 18 to order. Free Catalog.

STARE
P.O. Box 17974, Milwaukee, WI 53217
Call (414) 466-3381

CIRCLE 731 ON READER SERVICE CARD

Relaxation Software on Your PC
28 geometric images with gently changing colors. Designed by an experimental psychologist to reduce tension. $49. (NY State residents add sales tax.) Specify disk size. Requires VGA, 640k RAM, MS-DOS.

Executive Spectrums
27 Wilson Street
Port Jefferson Station, NY 11776 USA

CIRCLE 732 ON READER SERVICE CARD

MULTIPLY—
Your sales by handing your business card to over 900,000+ buyers at one time in the place where they seek to buy—tell them about your product in PC Magazine Marketplace BusinessCard.

BusinessCard
Call your BusinessCard representative today.
1-800-825-4237

CIRCLE 733 ON READER SERVICE CARD

PC MAGAZINE MARKETPLACE BUSINESSCARD

FINANCIAL

CONTRACT COLLECTOR™
For banks, finance companies & private investors collecting installment payment loans, notes, contracts & mortgages. Handles escrows, reserve collections, adjustable rate & prime rate indexed loans. Includes complete G/L. Prints IRS forms.

COMTRONIC SYSTEMS, INC.
205 Harris Avenue, Cle Elum, WA 98922
Tel: (509) 674-7000 Fax: (509) 674-2383

CIRCLE 734 ON READER SERVICE CARD

INVENTORY

INVENTORY MANAGEMENT
Stock-Master 4.0, com. grade system, has Stock Status Rptg, PO Write & Track, Trend Analysis, QC Rptg, Trans Hist Detail Analysis, Multi Loc support, BOM, Matl Req Planning, Serial/Lot No Track, Quote/Ord/Inv Prep.

Applied Micro Business Systems, Inc.
177F Riverside Ave., Newport Beach, CA 92663
714-759-0582

CIRCLE 740 ON READER SERVICE CARD

MAINTENANCE/PREVENTIVE MAINTENANCE

MAINTENANCE MANAGEMENT
PC-based system for the small to medium size business. FEATURES: Work Orders (space for detail instructions & safe work procedures), equipment descriptions, historical data, operating & analytical reports, inventory. Write for free Demo!!

PENGUIN COMPUTER CONSULTANTS
P.O.Box 20485, San Jose, CA 95160
800-521-0545 (408)997-7703 Fax (408)927-0570

CIRCLE 746 ON READER SERVICE CARD

FOREIGN LANGUAGES

FRENCH SOFTWARE? OUI!
Authorized dealer for 100's of French SW titles from Lotus, MS, Borland, Symantec, etc. Original mfrs. versions, all at discount prices. Specials: dbase IV 1.5 $519 MS WORD WINDOWS 2.0 $289 Harvard Graphics 3.0 $379. Nous parlons francais!

ADP Ltd.
5795 St. Francois Montreal, Que. H4S 1B6
Tel: (514) 335-6892 FAX: (514) 335-1089

CIRCLE 735 ON READER SERVICE CARD

dFELLER Inventory
Business inventory programs written in modifiable dBASE source code. dFELLER Inventory $150, dFELLER PLUS $200 with History and Purchase Orders (Good for Stockrooms) Requires dBASE III PLUS, or dBASE IV.

Feller Associates
550 CR PPA, Route 3, Ishpeming, MI 49849
906-486-6024

CIRCLE 741 ON READER SERVICE CARD

MANUFACTURING

Integrated Mfg/MRP Software
BOM, MRP, P.O., Cust Ords & Invcng, Mfg & Inv Ctrl, AP, AR, GL. Paradox based, function or menu, user defined reports, 999 price tables, context help, full function demo $45, single user $226, network available. Most Credit Cards.

Project Management Associates
P.O. Box 460022, Aurora, CO 80046-0022
1-800-722-7855

CIRCLE 747 ON READER SERVICE CARD

MAILING PROGRAMS

French, Spanish, German, Russian
We stock a full line of top quality unidirectional and bidirectional PC translation software. English to French from $69.95 (our own), English to Spanish from $129.95. $5 S&H, Visa/MC. Give us a call with your foreign language software needs.

Fluensys Corporation
10451 Mill Run Circle, Suite 400
Owings Mills, MD 21117 (800) 243-4470

CIRCLE 736 ON READER SERVICE CARD

Mail Order Manager™
America's most popular solution for mail & phone order businesses - order entry/review, credit card processing, UPS manifesting, profit analysis, acctg, telemkt'g, list mgmt. Clipper compiled/-dBase III+ files. Single station & network versions. Demo kit.

Dydacomp Development Corp.
150 River Road, Ste N1 Dept.PCM, Montville, NJ 07045 Tel:800-858-DMOM or 201-335-1256

CIRCLE 742 ON READER SERVICE CARD

FLEXIBLE INTEGRATED MFG.
Advanced SUMIT
- Manufacturing
- Materialle
- Advanced Manufacturing
- Accounting

Customizable, Modular, Relational DBMS, PC LAN Based

T.L. Creates, Inc.
345 N.Yosemite St., Ste 200, Stockton, CA 95203
Tel: (209)-946-0105 Fax: (209)-946-0150

CIRCLE 748 ON READER SERVICE CARD

GENERAL

DIGITAL RESEARCH PRODUCTS
ARE STILL AVAILABLE; Partial List:
GEM BASED PRODUCTS: GEM DRAW PLUS
GEM DESKTOP
OPERATING SYSTEMS: DR MULTI-USER DOS
CONCURRENT DOS

DISCUS DISTRIBUTION
8020 San Miguel CYN Rd., Salinas, CA 93907
408-663-6966

CIRCLE 737 ON READER SERVICE CARD

SoftSpoken Mailer for Windows
Print USPS-certified barcode on ordinary mailing labels. Presort 1st/3rd Class for rates as low as 11.4¢! Get ZIP+4 & forwarding addresses. De-dupe lists. Easy to use - Windows 3.0-3.1. $295; 60-day $-back guarantee.

SoftSpoken Inc.
PO Box 18343, Raleigh, NC 27619
Tel: (919) 870-5694 Fax: (919) 870-5696

CIRCLE 743 ON READER SERVICE CARD

MEDICAL

PRACTICE BILLING
MD VersaForm,flexible,ledger based design,billing package. Programmable; customizable reports, files, & screens; includes database mgmt system & full source. ECS. LAN support. $1,295 sgl user. Free lit & demo. Dirs wanted.

Applied Software Technology
591 W.Hamilton Ave., Ste 201, Dept. 99
Campbell, CA 95008 (800) 678-1111 Ext.99

GRAPHICS

Optical Graph Recognition (OGR) SW
SCAN-X™ software imports, converts and manipulates data from scanned plots, pictures, graphs on paper, or captured screens into data files for comparing/analyzing/plotting/exporting. FREE Demo disk. Service available.

SoloSoft
P.O. Box 2548, Stamford, CT 06906-0548
Phone: (203) 977-8161 Fax: (203) 977-8237

CIRCLE 738 ON READER SERVICE CARD

SUBSCRIPTION FULFILLMENT
Labels, bills, renewals, reports, and more on your PC. QUICKFILL used by over 400 publications in six countries. Fast - flexible - complete. Handles from 1,000 to 300,000 subscribers.

CWC Software, Inc.
150 Grossman Dr., Braintree, MA 02184
Phone (617) 843-2010 Fax (617) 843-8365

CIRCLE 744 ON READER SERVICE CARD

PRACTICE BILLING - Software
Nationwide use since 1979. ELECTRONIC CLAIMS. Full support. Simple Q/A. Full pt. ledgers, stmts, reports, everything. Tutorial. On-line help. LAN compatible. Physician designed. Single User: $495+. Newsletter, FREE WORKING DEMO, virus free.

Physicians' Office Computer
1240 Kona Drive, Rancho Dominguez, CA 90220
800-782-5214

CIRCLE 750 ON READER SERVICE CARD

HEALTH

Nutrition & Fitness Software
The TOP-Rated Software. Lose weight! Plan workouts! Control fat, cholesterol, salt! Plan/analyze menus! GET RESULTS! Personal & professional software. 50+ functions, terrific reports, 2000-11,500 foods. From $29 - $995. FREE Demo Disk.

ESHA Research
POB 13028M, Salem, OR 97309-1028
503-585-6242 fax: 503-585-5543

CIRCLE 739 ON READER SERVICE CARD

Shake Hands
With over 900,000+ of the most qualified PC buyers in the market—right here—in PC Magazine Marketplace BusinessCard.

BusinessCard
Call your BusinessCard representative today.
1-800-825-4237

CIRCLE 745 ON READER SERVICE CARD

MUSIC

SongWright Out Scores The Rest
"Impressive output...solid list of features."
An Electronic Musician survey proves SongWright the BEST BUY of all music notation software. Save hundreds of dollars. Make your music easy with SongWright. Only $119.95.

SongWright Software
7 Loudoun Street S.E., Leesburg, VA 22075
(800) 877-8070 (703) 777-7232

CIRCLE 751 ON READER SERVICE CARD

PC MAGAZINE MARKETPLACE BUSINESSCARD

PROGRAMMERS TOOLS

Translate dBASE programs to C
CodeTranslator converts dBASE programs into working C applications. This turbo charges slow dBASE applications, helps you port to Unix, MS Windows, or OS/2, and helps dBASE programmers learn C easily. Call now for more info.

SEQUITER SOFTWARE
#209, 9644-54 Ave, Edmonton, AB, Can. T6E 5V1
Call (403) 437-2410 Fax (403) 436-2999
CIRCLE 752 ON READER SERVICE CARD

BASIC PROGRAMMING TOOLS
Crescent offers many tools for QuickBASIC, PDS, and Visual Basic, all with tutorials and full source. Assembly routines, graphics, screen design w/data entry, BASIC TSR's, and much more. No royalties. Call or write for our catalog.

CRESCENT SOFTWARE, INC.
11 Bailey Avenue, Ridgefield, CT 06877
Orders: 800-35-BASIC, Tech: 203-438-5300

Boost Your BASIC with ProBas 5.5!
•Adds 938 new commands to QB/PDS/VBDOS •Written in assembly for speed•Gives your programs a professional look•Easy-to-use, $back guarantee •17 Other add-Ons for BASIC, C & VB: FREE DEMO DISK AND BOOKLET

TeraTech
100 Park Ave.#360,D1011, Rockville, MD 20850
(800) 447-9120 ext.1011 Fax:(301) 762-8185

Powerful Turbo Pascal Tools
Libraries from TurboPower help you develop Turbo Pascal applications easier and faster. Experts say "An Essential Toolkit", "Outstanding", OOP and non OOP libraries, BTree, Async and more. Call or write for a FREE brochure.

TurboPower Software
P.O. 49009 Colorado Springs, CO 80949-9009
(800) 333-4160, FAX (719) 260-7151

REAL ESTATE

Property Management
With Rental-Ease save $$ on your investment! Guaranteed to be the easiest & fastest property management system available at any price. Versions for owners, professionals, networks. $395 to $1295. Demo $10. Dealers welcome!

Strategic Office Systems
688 N.500 W.#61, Mt. Pleasant, UT 84647
(800) 942-6784 or (801) 462-2130
CIRCLE 756 ON READER SERVICE CARD

Property Management
Software for managing residential, commercial, condos, etc. Basic version for owner/manager-$495, Deluxe for professional managers- $1,195, Network-$2,395. Includes check writing, recurring expenses, G/L, management reporting.

YARDI SYSTEMS, INC.
819 Reddick Street, Santa Barbara, CA 93103
(805) 966-3666
CIRCLE 757 ON READER SERVICE CARD

The Landlord® & The Landmaster®
Property management software purchased by more than 5,000 owners and property managers since 1980. Handles residential and commercial tenant accounting: prints checks and statements. G/L and A/P included. From $595 to $2200.

The Landlord Software Center
427 East Patrick Street, Dept. E
Frederick, MD 21701 (301) 695-1544
CIRCLE 758 ON READER SERVICE CARD

Comtronic Property Manager™
Integrated mgmt & acct'g system for residential, retail & commercial properties. Supports lease controls & maint. tracking. Complete G/L w/recurring payables. Prints checks, notices, invoices & reports. Meets or exceeds all IREM standards.

COMTRONIC SYSTEMS, INC.
205 Harris Avenue, Cle Elum, WA 98922
Tel: (509) 674-7000 Fax: (509) 674-2383
CIRCLE 759 ON READER SERVICE CARD

RELIGION

Bible Study Software
For 10 years we have remained the leading Bible study software company. Think of us as a Bible bookstore with an integrated family of software products for your Bible study needs! Call for a FREE catalog!

Bible Research Systems
2013 Wells Branch Pkwy. #304 Austin, TX 78728
1-800-423-1228 1-512-251-7541

SCIENTIFIC

Weather Monitor & Weatherlink!
The ultimate in weather monitoring systems! A state-of-the-art weather station and a PC link allow you to view, record, summarize, and graph weather information. The perfect marriage of computer and weather technology.

DAVIS INSTRUMENTS
3465 Diablo Avenue, (PN19), Hayward, CA 94545
1-800-678-3669 Fax: 1-510-670-0589
CIRCLE 761 ON READER SERVICE CARD

STATISTICS

NCSS 5.x Series - $125
"Best value & easiest to learn/use" PC-Week. Menus/Spreadsheet. Means, etc. Regression, t-tests, ANOVA. Factor, cluster & discriminant. Cross tabs. Nonparametrics. Histograms. Plots. Reads ASCII/Lotus. Many extra modules.

NCSS
329 North 1000 East, Kaysville, UT 84037
Phone: 801-546-0445 FAX: 801-546-3907
CIRCLE 762 ON READER SERVICE CARD

WinSTAT™ Statistics for Windows
All the statistics you need, all the convenience of Windows! Up to 65,000 variables/cases. Copy/paste data from your spreadsheet. Output tables/graphs to your word processor Complete package $395. Demo $10. Call for brochure. V/MC/PO.

Kalmia Co. Inc.
71 Dudley St., Dept. 34, Cambridge, MA 02140
Phone/FAX: (617) 864-5567
CIRCLE 763 ON READER SERVICE CARD

SURVEYS

The Survey System
Analyzes:marketing, public opinion, customer satisfaction, employee attitude surveys. Handles mail, personal, phone, scanner, disk-by-mail or computer interviews. Records verbatim text & voice answers. Powerful, flexible, user friendly. Free support.

Creative Research Systems
15 Lone Oak Ctr. Dept. P, Petaluma, CA 94952
Ph.(707)765-1001 Fax (707)765-1068

#1 In Surveys - StatPac Gold IV
Professional's choice for survey & marketing research. User-friendly, comprehensive & dependable. Camera ready tables & graphics. Basic & advanced statistics. CRT & telephone interviewing. Easiest to learn. Guaranteed.

StatPac Inc.
3814 Lyndale Ave. S., Mpls., MN 55409
Tel: (612) 822-8252 Fax: (612) 822-1708
CIRCLE 765 ON READER SERVICE CARD

UTILITIES

PEN PLOTTER EMULATOR
FPLOT turns your printer into an HP pen plotter. Fast hi-res, no jagged lines. Vary line width, color. Screen preview - zoom, pan. Works with most CAD programs. Supports most printers. Requires DOS 2.1 or higher. $119+$3 S&H. VISA/MC/Chk/MO.

FPLOT Corporation
24-16 Steinway St., Suite 605
Astoria, NY 11103 • 718-545-3505
CIRCLE 766 ON READER SERVICE CARD

REMOVE HARDWARE LOCKS
Protect your investment! Maintain Productivity! Software utility that allows for the removal of hardware locks. Available for most CAD/CAM & PCB sw programs. Easy - Simple - Guaranteed Programs start at $99.00 Call or Fax for info.

SafeSoft Systems Inc.
201 - 1111 Monroe Ave., WPG, Mb, CANADA
R2K 3Z5 (204)669-4639 Fax(204)668-3566
CIRCLE 767 ON READER SERVICE CARD

VOICE/FAX

Multi-Voice (R) / Multi-Fax (R) Tools
Complete "C" development Toolkits. Accesses all features of speech processing boards. Helps write Multi-Line Voice/Fax (CAS) systems in minutes. Examples provided. Source code incl. Dialogic, Rhetorex, Newvoice:$599: Watson: $99:Fax: $199

ITI Logiciel
4165 A St-Denis, Montreal,Quebec,Can.H2W 2M7
Tel: (514) 847-2240 Fax: (514) 847-2242 V/MC

Hand Your Business Card...
To 900,000+ of the most qualified buyers in the PC market. These brand-specifiers are looking to buy while reading the industry's #1 publication. There is no more cost-effective or efficient way for you to build sales.

BusinessCard
Call your BusinessCard representative today.
1-800-825-4237
CIRCLE 769 ON READER SERVICE CARD

PC MAGAZINE MARKETPLACE BUSINESSCARD

WINDOWS

Pinpoint PC Bottlenecks
- Personal Measure shows how apps spend time.
- Upgrade or replace PCs based on hard facts.
- Identify network trouble spots.
- Resolve app problems using our services.
- $125 + S&H (5.25" or 3.5") MC/VISA

SPIRIT OF PERFORMANCE, INC.
73 Westcott Road, Harvard, MA 01451
tel. 508/456-3889, telex 6503571400

CIRCLE 770 ON READER SERVICE CARD

WINDOWS - LAN-EMAIL- from $99.95
"While You Were Out!" is MS Windows based, LAN compatible Messaging System. Users on your network may send, receive, save, print, forward & group messages to each other. Ensure timely & accurate messaging. No more pink message slips!

ComputerHelp Resources Inc.
To Order: 800-448-4469 or 800-EGG-HEAD
FAX: 604-244-8360

CIRCLE 771 ON READER SERVICE CARD

We Make It So Easy—
Leave your business card with us and we'll do the rest. PC Magazine will create your BusinessCard for you. It's so easy—and so very effective.

BusinessCard
Call your BusinessCard representative today.
1-800-825-4237

CIRCLE 772 ON READER SERVICE CARD

MISCELLANEOUS/ ACCESSORIES

STOP COMPUTER PAIN NOW!
CompUrest relieves repetitive stress injuries by supporting your forearms and lowering your keyboard. Why stop at your wrist? Go all the way to computer comfort. Available in solid oak, Lucite and Plastic. Meas. 21" X 23"

CompUcube, Inc.
US Pat. Ser. No. 071732, 791
1-800-458-3842 or 212-757-8043

CIRCLE 776 ON READER SERVICE CARD

INSURANCE

Insures Your Computer
The COMPUTEROWNERS Insurance Policy provides replacement of hardware, media and purchased software. As little as $49 a year covers theft, accidents, power surges and more! For information and to start coverage call 1-800-848-3469.

Safeware, The Insurance Agency Inc.
PO Box 02211, 2929 N. High St.
Columbus, OH 43202 800-848-3469

CIRCLE 777 ON READER SERVICE CARD

Insurance For Business Computers
Covers desktops, laptops, networks, all software, and even valuable data files. Don't settle for policies designed for home computers or office typewriters if you use your system for business. Low premiums. Call 24 hrs. to receive application.

DATA SECURITY INSURANCE
4800 Riverbend Road, Boulder, CO 80301
1-800-822-0901

ON-LINE SERVICES

HEAT IN THE NIGHT
FREE! FREE! FREE! FREE! FREE! FREE! FREE! FREE!
THE HOTTEST AND ONLY
FREE BBS in the country.
It's where erotic couples & singles meet.
XXX CHAT

ALWAYS FREE - NEVER A CHARGE!
1-515-FUNN-BBS

SERVICES

FOR HIRE - TYPIST–1,800 WPM
- Why type when we can SCAN it?
- Fast, Accurate, Inexpensive. Overnite Svc Avail
- Any text-docs, financials, lists, mnscrpts, etc.
- Converted to diskette file for any PC or Mac program—spreadsheet, word processor, database

ScanType
6557 Via Barona, Carlsbad, CA 92009
(800) 597-SCAN In CALIF: (800) 300-SCAN

CIRCLE 783 ON READER SERVICE CARD

Your Success Is In The Cards...
In the PC Magazine Marketplace BusinessCard pages. Advertise in every issue—pay less and increase impact.

BusinessCard
Call your BusinessCard representative today.
1-800-825-4237

CIRCLE 784 ON READER SERVICE CARD

PC MAGAZINE MARKETPLACE

PC MAGAZINE MARKETPLACE
One Park Avenue
Third Floor
New York, NY 10016
Attn.: Monte Wasch

For more advertising information, call 212-503-5115 or 1-800-825-4237.

ADVERTISING ACCOUNT REPRESENTATIVES

Michael Alexander 212-503-5118
CA (408, 415)

Tim Castelli 212-503-5125
AK, AZ, CA (209, 510, 707, 714, 805, 916), CN, NM, OK, Foreign

Leslie Eddy 212-503-5171
AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, TX, VA, WV

Bill Herbst 212-503-5193
CT, MA, ME, NH, NJ, RI, VT

Elizabeth Osias 212-503-5167
DC, DE, MD, NY, OH, PA

Caroline Padron 212-503-5156
CO, ID, MT, NV, OR, UT, WA, WY

Claudia Porfilio 212-503-5184
CA (213, 310, 619, 818), HI

Tim Stanton 212-503-5175
IA, IL, IN, KS, MI, MN, MO, ND, NE, SD, WI

BusinessCard
Account Representatives

Carolyn Goldfarb 212-503-5076
Andrew Kramer 212-503-5150

NATIONAL ADVERTISING STAFF

Vice President,
Central Advertising
Paul Stafford

Sales Manager
Monte Wasch

Sr. Advertising Coordinator
Wanda D. Brown

Advertising Coordinator
Krupal Prabhaker

Production Manager
Vicki Egan

Assistant Production Manager
Bessi Dion

Sr. Production Coordinator
Nadine Messier

Production Coordinator
Berhan Asmarom

"Normally, I'd say get back to me by the end of the day. Or later in the week. But that was before I started using Computer Select®. With this incredibly useful CD-ROM product, I can now cut out enormous amounts of time and go right to the source. Without having to flip through tons of magazines using up stacks of yellow stickies.

"Pretty amazing, you say? Well it is. You see, Computer Select gives me access to all the pertinent hardware specs I need, along with thousands of articles, reviews and evaluations. Not to mention new publications I'd otherwise never know about. What's more, with Computer Select, not only can I evaluate different products, but I can also research the pros and cons of a product from lots of different perspectives instead of just one or two. What I end up with is a documented trail of alternative choices along with plenty of materials that support the product we ultimately choose. I also end up feeling pretty confident and, well, looking sort of super-human, if you know what I mean. And that feels pretty good, too."

"They asked me to find all 486 notebooks with a PCMCIA slot for under $4,000. I said, 'Hey, I'm only human. Give me thirty seconds'."

Imagine being able to find ten product reviews in a minute. Instead of one review in ten minutes. Imagine being able to make better, more informed purchasing decisions without wondering whether you've overlooked an important article that may have been written 5 months ago. Imagine doing it all with lightning speed, selectively choosing specific information rather than randomly flipping through piles of publications.

Enter Computer Select, the unique CD-ROM product that provides all the information you need to identify, evaluate and select software, hardware and communications products.

MONTHLY UPDATES.

As a subscriber, you'll receive a new disc every month for a year. On each disc, you'll find product information from over 160 leading computer publications. And every last word written in every product review, news article and opinion or tip column from magazines such as PCWeek, InfoWorld, PC Magazine, MacUser, LAN Times and 50 others.

Once you've researched a product such as 486 notebooks for under $4,000 and made your decision, what's next? Well, you could then use Computer Select, for example, to evaluate appropriate printers to work with the notebooks. Or you could explore the best word processing programs that run on them. Or look for the best price on a pocket LAN adapter to get your notebooks up on the network. The point is, there's no end to the uses you can put it to.

In addition to containing specifications on over 75,000 hardware, software and data communications products, you'll also find definitions of over 12,000 computer and telecommunications terms. Along with corporate profiles and telephone numbers of over 13,000 computer companies.

All of which easily makes Computer Select the most comprehensive source of computer information available, anywhere.

INSTANT PRODUCTIVITY.

Okay, but given the richness of all this information, you may be asking yourself about ease of use. Well, for one thing, you don't need any special training at all. In fact, you can start using Computer Select right after you install it.

Basically, all you need to do is type in either a word or key phrase related to the subject you're researching. Its powerful search-and-retrieval engine will then, in a matter of seconds, deliver precisely what you're looking for.

Imagine going right to the product information you need in a matter of seconds.

INSTANT RETURN ON INVESTMENT.

Now, how much would you expect to pay for a product that delivers so much? Surprisingly, the cost of a year's subscription is less than a few dollars a day. Which isn't much at all when you consider the benefits.

Computer Select. It's the most comprehensive source of computer information available anywhere.

So take a minute to call us today for your free product evaluation. And then start imagining how much better you'll feel about the recommendations you make.

Call today for your free product evaluation*

1-800-827-7889
ext. 115

ZIFF Desktop Information

CIRCLE 158 ON READER SERVICE CARD

Computer Select. Because even the experts need an expert.

© 1993 Ziff Communications Company. Ziff Desktop Information and Computer Select are trademarks of Ziff Communications Company. All rights reserved. *Conditions apply

Advertising Sales Staff

One Park Avenue,
New York, NY 10016
212 503-5100

DISPLAY ADVERTISING

Dan Rosensweig - Associate Publisher
(212) 503-5354
Anna Zornosa - Associate Publisher/West Coast
(415) 378-5505
Robert Diftler - Central Advertising Manager
(312) 346-7666
Lee Otremba - East Coast Advertising Director
(212) 503-4453
Sales Manager
Michael Hatherill
(212) 503-5128
Ad Systems Supervisor
Christine Holsten
(212) 503-5264
Advertising Coordinator
Julie Eigo
(212) 503-5107

MA, NH, VT, ME, RI

District Sales Manager
Kimberly Rene White
10 President's Landing, Mystic Central
Medford, MA 02155
(617) 393-3055
Account Representative
Ira Becker
(212) 503-5132

CT, NY, NJ, PA

District Sales Manager
Michael Bird
One Park Avenue, 4th Floor
New York, NY 10016
(212) 503-5307
District Sales Manager
Lisa Friedman
(212) 503-5149
Sr. Account Representative
Karen Keavey
(212) 503-5333
Account Representatives
Andrew Jacobs
(212) 503-5130
Adam Power
(212) 503-5663

DE, MD, DC, VA, WV, NC, SC, AL, MS, TN, AR, KY, GA, FL

Frank Quigley
3405 Piedmont Road, Suite 460
Atlanta, GA 30305
(404) 814-8950

Account Representative
Allyson Deane
(212) 503-5044

NE, WI, IL, IN, KS, MN, MO, OH, MI, IA, ND, SD, Canada

District Sales Manager
Stephen Dress
150 North Wacker Drive, 25th Floor
Chicago, IL 60606
(312) 346-7666
District Sales Manager
Jay Overbye
(312) 346-7666
Sr. Account Representative
Beth Boyle
(212) 503-5047
Account Representative
Maureen Dooley
(212) 503-5126

TX, OK, LA, NM

District Sales Manager
Paul Klein
5956 Sherry Lane, Suite 625
Dallas, TX 75225
(214) 360-5725
Sr. Account Representative
Stephanie Brzozowski
(212) 503-5675

CA (San Diego & Orange County), AZ, NV, HI

District Sales Manager
David Lynn (714) 852-5924
18500 Von Karman Avenue, Suite 510
Irvine, CA 92715
(714) 852-5914
District Sales Manager
Robin Kofsky
(714) 852-5920
Sr. Account Representative
Molly Shank
(212) 503-5113

CA (Los Angeles)

District Sales Manager
Mary Ariotto (213) 351-1811
3530 Wilshire Boulevard, Suite 645
Los Angeles, CA 90010
(213) 351-1810
Account Representative
Elizabeth O'Connor
(212) 503-5040

CA (San Jose)

District Sales Manager
Michael Klein (415) 378-5521
110 Marsh Drive, Suite 103
Foster City, CA 94404
(415) 378-5520

Sr. Account Representative
Kathy Kottenbach
(212) 503-5041

Mike Kisseberth - Northwest Advertising Manager
(415) 378-5510

CA (San Francisco & North), ID, OR, WA

District Sales Representative
Todd Anderman (415) 378-5527
110 Marsh Drive, Suite 103
Foster City, CA 94404
(415) 378-5520

District Sales Representative
Rick Vandervoorn
(415) 378-5523

Account Representative
Mike Medwig
(212) 503-5129

CA (South San Francisco to Mountainview), CO, UT, WY, AK

District Sales Manager
Phyliss Egan
110 Marsh Drive, Suite 103
Foster City, CA 94404
(415) 378-6859

Sr. Account Representative
Kathy Kottenbach
(212) 503-5041

Account Development Specialist
Ronni Reiburn
(212) 503-5104

For more information regarding *display* advertising please call:
212 503-5100
1-800-33MAG AD

CENTRAL ADVERTISING

VP, Central Advertising
Paul Stafford

Sales Manager
Monte Wasch

Production Director
Anne Brockinton

Sr. Production Coordinator
Mary C. Murawinski

Production Coordinators
Berhan Asmarom
Nadine Messier

Sr. Advertising Coordinator
Wanda D. Brown

Advertising Coordinator
Krupal Prabhaker

CA (415, 408)

Account Representative
Michael Alexander
(212) 503-5118

AK, AZ, CA (209, 510, 707, 714, 805, 916), CN, NM, OK, Foreign

Account Representative
Tim Castelli
(212) 503-5125

AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, TX, VA, WV

Account Representative
Leslie Eddy (South East)
(212) 503-5171

CT, MA, ME, NH, NJ, RI, VT

Account Representative
Bill Herbst
(212) 503-5193

DC, DE, MD, NY, OH, PA

Account Representative
Elizabeth Osias
(212) 503-5167

CO, ID, MT, NV, OR, UT, WA, WY

Account Representative
Caroline Padron
(212) 503-5156

CA (213, 310, 619, 818), HI

Account Representative
Claudia Porfilio
(212) 503-5184

(IA, IL, IN, KS, MI, MN, MO, ND, NE, SD, WI)
Tim Stanton
(212) 503-5175

AK, AR, AZ, CA (619), LA, NM, OK, TX

Account Representative
(212) 503-5117

Business Card Account Representative
Carolyn Goldfarb (212) 503-5076 &
Andrew Kramer (212) 503-5150
PC Magazine Marketplace
3rd Floor, One Park Ave.
New York, NY 10016

For more information regarding *central* advertising please call:
212 508-5115
1-800-825-4237

Advertisers' Index

COMPANIES

Reader Service No.	Advertiser	Page
293	3 Com Corporation	264-265
094	3-D Visions Inc	283
034	Acer America	106-107
368	Adobe Systems Inc	287
047	Advanced Micro Devices	104
194	Amax Engineering	98
162	American Power Conversion	268
025	American Small Business Computers	408
209	Ariel Design Inc	348
336	Arlington Computer Products	402-403
254	Artisoft Inc	47
008	ASP Computer Products	88
*	AST Research	20-21
323	AT&T Paradyne	175
228	ATI Technologies Inc	89
012	Austin Computer Systems	13-15
091	Autodesk Retail Products	100
090	Beame & Whiteside	225
285	Borland International	6
287	Borland International	51
220	Borland International	54-55
328	Buffalo Products	392
015	Bulldog Computer Products	412
190	CallSoft	80
*	Canon Computer Systems	123
073	Colorado Memory Systems	36
128	CompuAdd Express	284-285
126	CompuAdd	67-70
205	Compuclassics	411
132	CompuDyne	194-195
357	CompuDyne	304-305
300	Computability	388-389
348	Computer Associates	2-3
400	Computer Associates	5
109	COMPUTER DISCOUNT WAREHOUSE	404-407
177	Computer Express	410
033	Computer Library	328
158	Computer Library	443
316	Comtrade	369
011	Corel Corporation	281
086	Creative Labs	61
389	DCA	227
*	Dell Computer Corporation	78-79
*	Dell Computer Corporation	C5-C8
*	Dell Computer Corporation	228-229
*	Dell Computer Corporation	256-257
*	Dell Computer Corporation	291
250	Delrina Technology	43
143	DTK Computer	198-199
168	Dustin Discount Software	334
347	Dustin Discount Software	342-343
362	Eastman Kodak Company	177
119	Edge Technology	365-368
197	EPS Technology	352-353
*	Epson America	62-63
305	Expo Tech	375-377
032	FASTMICRO	355-362
352	FASTMICRO	396-397
382	First Source International	413
*	Gateway 2000	250-251
*	Gateway 2000	48a-j
014	Grid Systems Corporation	162-163
391	H.Co Memory Upgrades	399
*	Hard Drives International	340-341
136	Hayes Microcomputer Products	76
262	Hewlett Packard Dashboard	58
275	Hyundai Electronics	90-91
*	IBM Corporation	117-120
066	IBM Corporation	183-186
024	IBM Corporation	215
*	Insight Distribution Network	336-339
363	Intel Corporation	96-97
007	KeyData International	350
106	Kingston Technology	24-25
019	L.A. Trade	414
237	Lasermaster	308
182	Logitech	127
*	Lotus Development Corporation	72-73
*	Lotus Development Corporation	74-75
263	Macola, Inc	161
098	Madge Networks Inc	220
067	Mag Innovision	293
365	Manugistics	101
291	Mapping Info. Systems	255
050	Mathsoft Inc	181
093	Media Vision	86
085	Micro Center	151
005	Micro Solutions Computer Products	243
*	Microcom	65
361	Micrografx	41
119	Micron Cmputers	365-368
*	Microsoft	C2-C4,p1
*	Microsoft	102-103
225	MicroWarehouse	189-190
010	Midwest Computer Works	390
112	Mitac	386-387
157	NEC Technologies	26-27
394	NEC Technologies	84-85
*	Northgate Computer Systems	238-239
060	Ocean Isle Software	267
056	Okidata	45
*	Pacific Data Products, Inc	23
*	Pacific Data Products, Inc	247
145	Pacific Wave Technology	415
029	PC Brand	154-157
*	PC Connection	208-211
199	PC Zones	394-395
268	PCs Compleat	382-383
092	PCs Compleat	384-385
324	Peripheral Express	401
026	Personics	4
097	Port, Inc	219
148	Primavera Systems	82
314	Publishing Perfection	409
*	Quill Corporation	379-381
296	SAMTRON	18
*	Seagate Technology	94
006	ShapeWare	57
213	Sigma Data	263
212	SoftMaker	139
373	Software Add-Ons	400
*	Software Publishing	10-11
071	Sony Computer Peripheral	16-17
377	Sony Recording Media	271
057	StatSoft	83
221	Strategic Mapping, Inc	216
183	Supra Corporation	262
350	Symantec Corporation	28
045	Tangent Computer, Inc	346
101	TELEMART	391
206	TELEMART	393
353	Texas Instruments	203
304	Texas Instruments	242
379	Toshiba America	178-179
121	Tri-Star Computers	364
231	US Robotics Inc	233
189	USA Flex	370-371
210	USA Flex	372-373
055	Video Seven	274
118	View Sonic	300-301
103	Wollongong Group	273
*	WordPerfect Corporation	295-297
211	Xircom	149
*	Zenith Data Systems	114-115
*	Zenith Data Systems	124-125
038	Zeos Int'l	33
036	Zeos Int'l	34-35
125	Zeos Int'l	92
151	Zeos Int'l	129-134
115/035	Zeos Int'l	135
152	Zeos Int'l	167-172
070	Ziff Desktop Information	320-321
354	Ziff-Davis Press	313

* No Reader Service #. Please Call Advertiser For Information.

Advertisers' Index
PRODUCTS

Reader Service No.	Company	Product	Page
ACCOUNTING SOFTWARE			
283	Macola, Inc.	Accounting Software	161
ADD-ON BOARDS			
086	Creative Labs	Sound Blaster 16 ASP	61
382	First Source International	Memory	413
237	Lasermaster	Win Print Products	308
213	Sigma Data	Upgrades	263
BACKUP SOFTWARE			
005	Micro Solutions Computer Products	Tape Backup, Disk Drives	243
BOOKS			
354	Ziff-Davis Press	Books	313
CAD/CAM			
025	American Small Business Computers	DesignCAD Professional	408
091	Autodesk Retail Products	Generic CADD 6.0	100
*	Pacific Data Products, Inc	Protracer	247
CD-ROM			
300	Computability	Mail Order	390-391
158	Computer Library	Computer Select	443
168	Dustin Discount Software	CD-ROM Products	334
*	Insight Distribution Network	Systems	336-339
005	Micro Solutions Computer Products	CD-ROM	243
324	Peripheral Express	Hardware/Peripherals	401
314	Publishing Perfection	Software,Peripherals,Hardware	409
071	Sony Computer Peripheral	Sony Desktop Library	16-17
CHIP/PROCESSORS			
047	Advanced Micro Devices	386 Microprocessor	104
328	Buffalo Products	Cyrix Chips	392
353	Intel Corporation	486SL	96-97
CO-PROCESSORS			
213	Sigma Data	Upgrades	263
COMMUNICATIONS SOFTWARE			
090	Beame & Whiteside	TCP/IP & NFS for DOS & Windows	225
139	Hayes Microcomputer Products	Optimas	78
283	Macola, Inc	Communications Software	161
060	Ocean Isle Software	ReachOut Remote Control	267
COMPUTERS/COMPATIBLES			
034	Acer America	PC's	106-107
194	Amax Engineering	Amax PC's	98
208	Ariel Design Inc.	Computers	348
*	AST Research	Premia Line	20-21
012	Austin Computer Systems	Austin Desktops	13-15
015	Bulldog Computer Products	Compatibles	412
126	CompuAdd	CompuAdd Systems	67-70
128	CompuAdd Express	CompuAdd Express PC's	284-285
357	CompuDyne	Compudyne Desktops	304-305
109	COMPUTER DISCOUNT WAREHOUSE	Hardware	406-407
316	Comtrade	Systems	369
*	Dell Computer Corporation	Dell Systems/Software	78-79
*	Dell Computer Corporation	Dell Systems	CS-C8
*	Dell Computer Corporation	Dell Systems/Software	228-229
*	Dell Computer Corporation	Dell Systems	256-257
*	Dell Computer Corporation	Dell Systems	291
143	DTK Computer	Systems	198-199
119	Edge Technology	PC's	365-368
197	EPS Technology	Systems	352-353
305	Expo Tech	486 DX2/50 Mhz, 486SX/25 Mhz	375-377
032	FASTMICRO	Systems	355-362
*	Gateway 2000	PC's	48a-1
014	Gnd Systems Corporation	GRiD Dekstops	162-163
275	Hyundai Electronics	486's	90-91
066	IBM Corporation	PS/Valuepoint Direct	183-186
*	Insight Distribution Network	Systems	336-339
007	KeyData International	Systems	350
085	Micro Center	WinBook Notebook	151
119	Micron Computers	PC's	365-368
010	Midwest Computer Works	Hardware, PC's	390
112	Mitac	Mitac PC's	386-387
157	NEC Technologies	PC's	26-27
394	NEC Technologies	Select Solutions	84-85
*	Northgate Computer Systems	PC's, Notebooks	238-239
145	Pacific Wave Technology	Computers	415
029	PC Brand	Mail Order, PC's	154-157
268	PCs Compleat	Computers	382-383
092	PCs Compleat	Computers	384-385
*	Quill Corporation	PC's	379-381
045	Tangent Computer, Inc.	486's	346
121	Tri-Star Computers	Systems	364
189	USA Flex	USA Flex Systems	370-371
*	Zenith Data Systems	PC's	114-115
*	Zenith Data Systems	PC's	124-125
038	Zeos Int'l	Zeos Color Notebook	33
036	Zeos Int'l	Zeos Contenda	34-35
125	Zeos Int'l	Zeos Pocket PC	92
151	Zeos Int'l	Zeos Upgradable	129-134
115/035	Zeos Int'l	Z-Card/Z-Quote	135
152	Zeos Int'l	Zeos Freestyle/SL	167-172
DATA BASE MANAGERS			
220	Borland International	Paradox for Windows	54-55
348	Computer Associates	dbfast	2-3
400	Computer Associates	CA Ret/x base	5

Reader Service No.	Company	Product	Page
DESK TOP PUBLISHING			
314	Publishing Perfection	Software,Peripherals,Hardware	409
DISK BACKUP & TAPE DRIVES			
073	Colorado Memory Systems	Trackker	36
300	Computability	Mail Order	390-391
005	Micro Solutions Computer Products	Tape Backup, Disk Drives	243
DISKETTES			
377	Sony Recording Media	D8	271
DISPLAYS/MONITORS/TERMINALS			
336	Arlington Computer Products	Mail Order	402-403
057	Mag Innovision	High Resolution Monitors	290
010	Midwest Computer Works	Monitors	390
324	Peripheral Express	Hardware/Peripherals	401
296	SAMTRON	Monitors	18
210	USA Flex	Peripherals	372-373
118	View Sonic	Monitors	300-301
ELECTRONIC MAIL			
090	Beame & Whiteside	TCP/IP & NFS for DOS & Windows	225
EMULATORS/PROTOCOL CONVERTERS			
*	Pacific Data Products, Inc.	PAC PAGE	23
FLOWCHARTING			
361	Micrografx	ABC FlowCharter 2.0	41
FONT SOFTWARE			
212	SoftMaker	Font Software	139
GRAPHICS SOFTWARE			
094	3-D Visions Inc.	Stanford Graphics 2.1	283
368	Adobe Systems Inc.	Illustrator for Windows	287
011	Corel Corporation	Corel Draw 3.0	281
*	Lotus Development Corporation	Freelance Graphics	72-73
006	ShapeWare	Visio	57
HAND-HELD PC'S			
125	Zeos Int'l.	Zeos Pocket PC	92
HARD DISKS			
300	Computability	Mail Order	390-391
*	Hard Drives International	Hard Drives	340-341
005	Micro Solutions Computer Products	Tape Backup, Disk Drives	243
*	Seagate Technology	ST3120	94
HARDWARE			
*	Epson America	Scanners	82-83
352	FASTMICRO	Software	396-397
352	FASTMICRO	Hardware	396-397
*	Hard Drives International	Hard Drives	340-341
*	Insight Distribution Network	Systems	336-339
145	Pacific Wave Technology	Mail Order,Computers,Software	415
199	PC Zones	Mail Order	394-395
HIGH RESOLUTION PRINTER BOARDS			
237	Lasermaster	Win Print Products	308
INPUT DEVICES			
182	Logitech	ScanMan Color	127
LAN ADAPTER BOARDS			
389	DCA	Token Ring	227
211	Xircom	Pocket LAN Adapter	148
LOCAL AREA NETWORKING			
293	3 Com Corporation	Etherlink III	264-265
254	Artisoft Inc.	LANTASTIC	47
008	ASP Computer Products	ServerJet	88
323	AT&T Paradyne	Dataport 14.4 Fax Modem	175
015	Bulldog Computer Products	Networking	412
300	Computability	Mail Order	390-391
109	COMPUTER DISCOUNT WAREHOUSE	Networking Products	404-405
033	Computer Library	SupportOnSite for Applications	328
389	DCA	Token Ring	227
030	Madge Networks Inc.	Token Ring	220
*	Microsoft	Windows for Workgroups	102-103
*	Northgate Computer Systems	Networking Products	238-239
045	Tangent Computer, Inc.	Servers	346
103	Wollongong Group	Pathway Access	273
211	Xircom	Pocket LAN Adapter	148
*	Zenith Data Systems	Network-Ready Products	114-115
*	Zenith Data Systems	Network Ready-Products	124-125
MAIL ORDER			
025	American Small Business Computers	DesignCAD Professional	408
209	Ariel Design Inc.	Mail Order	348
336	Arlington Computer Products	Mail Order	402-403
012	Austin Computer Systems	Austin Desktops & Notebooks	13-15
015	Bulldog Computer Products	Mail Order	412
190	CallSoft	Software	80
206	Compuclassics	Mail Order Products	411
132	CompuDyne	Compudyne Notebooks	194-195
357	CompuDyne	Compudyne Desktops	304-305
300	Computability	Mail Order	390-391
177	Computer Express	Mail Order	410
316	Comtrade	Systems, Mail Order	369
168	Dustin Discount Software	Mail Order Products	334

Advertisers' Index
PRODUCTS

Reader Service No.	Company	Product	Page
347	Dustin Discount Software	Mail Order Products	342-343
197	EPS Technology	Mail Order	352-353
305	Expo Tech	486 DX2/50 Mhz, 486SX/25 Mhz	375-377
352	FASTMICRO	Mail Order	398-399
382	First Source International	Memory	413
*	Gateway 2000	Mail Order	250-251
*	Gateway 2000	Mail Order	48a-j
014	Grid Systems Corporation	GRid Notebooks & Desktops	162-163
391	H.Co Memory Upgrades	Mail Order, Memory	399
*	Hard Drives International	Hard Drives	340-341
275	Hyundai Electronics	486's	90-91
068	IBM Corporation	PS/Valuepoint Direct	183-186
*	Insight Distribution Network	Systems	336-339
007	KeyData International	Systems	350
019	L.A. Trade	Mail Order, Memory	414
225	MicroWarehouse	Mail Order	189-190
010	Midwest Computer Works	Mail Order	390
394	NEC Technologies	Select Solutions	84-85
*	Northgate Computer Systems	Mail Order	238-239
029	PC Brand	Mail Order, PC's	154-157
*	PC Connection	Mail Order	208-211
198	PC Zones	Mail Order	394-395
268	PCs Compleat	Computers, Mail Order	382-383
092	PCs Compleat	Computers, Mail Order	384-385
314	Publishing Perfection	Software,Penpherals,Hardware	409
*	Quill Corporation	Mail Order	379-381
373	Software Add-Ons	Software	400
045	Tangent Computer, Inc	486's, Servers	346
101	TELEMART	Software, Resellers	391
206	TELEMART	Software, Resellers	393
121	Tri-Star Computers	Mail Order	364
189	USA Flex	USA Flex Systems	370-371
210	USA Flex	Peripherals	372-373
*	Zenith Data Systems	Mail Order	114-115
*	Zenith Data Systems	Mail Order	124-125
038	Zeos Int'l	Zeos Color Notebook	33
036	Zeos Int'l	Zeos Contenda	34-35
125	Zeos Int'l	Zeos Pocket PC	92
151	Zeos Int'l	Zeos Upgradable	129-134
115/035	Zeos Int'l	Z-Card/Z-Quota	135
152	Zeos Int'l	Zeos Freestyle/SL	167-172

MAPPING SOFTWARE

291	Mapping Info. Systems	MapInfo	256
221	Strategic Mapping, Inc.	LocalExpert	216

MASS STORAGE

300	Computability	Mail Order	388-389
*	Seagate Technology	ST3120	94

MEMORY

382	First Source International	Memory	413
391	H.Co Memory Upgrades	Memory, Mail Order	399
106	Kingston Technology	Memory	24-25
019	L.A. Trade	Mail Order, Memory	414
213	Sigma Data	Upgrades	263

MISCELLANEOUS

097	Port, Inc.	Laptop Bags	219
070	Ziff Desktop Information	ZiffNet	320-321

MODEMS

336	Arlington Computer Products	Mail Order	402-403
323	AT&T Paradyne	Dataport 14.4 Fax Modem	175
300	Computability	Mail Order	390-391
135	Hayes Microcomputer Products	Optimas	76
324	Peripheral Express	Hardware/Peripherals	401
183	Supra Corporation	Supra Fax/Modems	262
231	US Robotics Inc	Shared Access Modem ShareKit	233
210	USA Flex	Peripherals	372-373

MULTI-MEDIA

190	CallSoft	Software	80
096	Creative Labs	Sound Blaster 16 ASP	61
093	Media Vision	Pro Movie Spectrum	86
*	Quill Corporation	Hardware	379-381

ON LINE DATABASE

033	Computer Library	SupportOnSite for Applications	326
070	Ziff Desktop Information	ZiffNet	320-321

OS/2 SOFTWARE

*	IBM Corporation	OS/2	117-120

PC ACCESSORIES

005	Micro Solutions Computer Products	Tape Backup, Disk Drives	243

PC DIRECT

025	American Small Business Computers	DesignCAD Professional	408
208	Ariel Design Inc.	Computers, Mail Order	348
336	Arlington Computer Products	Mail Order	402-403
328	Buffalo Products	Cyrix Chips	392
015	Bulldog Computer Products	Compatibles/Networking	412
205	Compuclassics	Mail Order Products	411
300	Computability	Mail Order	390-391
108	COMPUTER DISCOUNT WAREHOUSE	Hardware, Peripherals, Laptops	404-405
177	Computer Express	Software, Mail Order	410
316	Comtrade	Systems, Mail Order	398
168	Dustin Discount Software	Mail Order & CD-ROM Products	334
347	Dustin Discount Software	Mail Order Products	342-343
119	Edge Technology	PC's	365-368

Reader Service No.	Company	Product	Page
197	EPS Technology	Systems, Notebooks, Mail Order	352-353
305	Expo Tech	486 DX2/50 Mhz, 486SX/25 Mhz	375-377
032	FASTMICRO	Systems	356-362
352	FASTMICRO	Software, Mail Order	398-399
382	First Source International	Memory	413
391	H.Co Memory Upgrades	Mail Order, Memory	399
*	Hard Drives International	Hard Drives	340-341
*	Insight Distribution Network	Systems	336-339
007	KeyData International	Systems	350
019	L.A. Trade	Mail Order, Memory	414
119	Micron Computers	PC's	365-368
010	Midwest Computer Works	Mail Order	390
112	Mitac	Mitac PC's	386-387
145	Pacific Wave Technology	Mail Order,Computers,Software	415
198	PC Zones	Mail Order	394-395
268	PCs Compleat	Computers, Mail Order	382-383
092	PCs Compleat	Computers, Mail Order	384-385
324	Peripheral Express	Hardware/Peripherals	401
314	Publishing Perfection	Software,Peripherals,Hardware	409
*	Quill Corporation	Mail Order	379-381
373	Software Add-Ons	Software	400
045	Tangent Computer, Inc.	486's, Servers	346
101	TELEMART	Software, Resellers	391
206	TELEMART	Software, Mail Order	393
121	Tri-Star Computers	Systems, Mail Order	364
189	USA Flex	USA Flex Systems	370-371
210	USA Flex	Peripherals	372-373

PC-FAX

323	AT&T Paradyne	Dataport 14.4 Fax Modem	175
183	Supra Corporation	Supra Fax/Modems	262

PERIPHERAL SHARING DEVICE

008	ASP Computer Products	ServerJet	88

PERIPHERALS

108	COMPUTER DISCOUNT WAREHOUSE	Peripherals	404-405
*	Gateway 2000	Peripherals	250-251
*	Gateway 2000	Peripherals	48a-j
*	Hard Drives International	Hard Drives	340-341
145	Pacific Wave Technology	Peripherals	415

PORTABLE/LAP COMPUTERS

*	AST Research	Premia Line	20-21
012	Austin Computer Systems	Austin Notebooks	13-15
126	CompuAdd	CompuAdd Systems	67-70
128	CompuAdd Express	CompuAdd Express PC's	284-285
132	CompuDyne	Compudyne Notebooks	194-195
108	COMPUTER DISCOUNT WAREHOUSE	Laptops	404-405
*	Dell Computer Corporation	Dell Systems/Software	78-79
*	Dell Computer Corporation	Dell Systems	CS-C8
*	Dell Computer Corporation	Dell Systems/Software	228-229
*	Dell Computer Corporation	Dell Systems	256-257
*	Dell Computer Corporation	Dell Systems	281
119	Edge Technology	PC's	365-368
197	EPS Technology	Notebooks	352-353
305	Expo Tech	Notebooks	375-377
*	Gateway 2000	Notebooks	250-251
*	Gateway 2000	Notebooks	48a-j
014	Grid Systems Corporation	GRiD Convertible & Notebooks	162-163
275	Hyundai Electronics	486's	90-91
024	IBM Corporation	Thinkpad	215
007	KeyData International	Systems	350
096	Micro Center	WinBook Notebook	151
119	Micron Computers	PC's	365-368
010	Midwest Computer Works	Hardware, PC's	390
112	Mitac	Mitac PC's	386-387
026	Personics	Laptop Ultravision	4
*	Quill Corporation	Notebooks	379-381
353	Texas Instruments	TI TravelMate Notebooks	203
379	Toshiba America	T4500 Notebook	176-179
189	USA Flex	USA Flex Systems	370-371
*	Zenith Data Systems	Notebooks	114-115
*	Zenith Data Systems	Notebooks	124-125
038	Zeos Int'l	Zeos Color Notebook	33
036	Zeos Int'l	Zeos Contenda	34-35
125	Zeos Int'l	Zeos Pocket PC	92
152	Zeos Int'l	Zeos Freestyle/SL	167-172

POWER PROTECTION

162	American Power Conversion	Smart UPS	286

PRESENTATION SOFTWARE

094	3-D Visions Inc.	Standard Graphics 2.1	283
*	Software Publishing	Harvard Graphics for Windows	10-11
*	WordPerfect Corporation	WordPerfect Presentations	295-297

PRINTER ACCESSORIES

008	ASP Computer Products	ServerJet	88
237	Lasermaster	Win Print Products	308

PRINTERS

*	Canon Computer Systems	BJ200 Printer	123
300	Computability	Mail Order	388-389
382	Eastman Kodak Company	Diconix Printer	177
*	Insight Distribution Network	Systems	336-339
237	Lasermaster	Win Print Products	308
056	Okidata	LED Printer	45
324	Peripheral Express	Hardware/Peripherals	401
314	Publishing Perfection	Software,Peripherals,Hardware	409
304	Texas Instruments	TI MicroLaser Printer	242
210	USA Flex	Peripherals	372-373

Advertisers' Index
PRODUCTS

Reader Service No.	Company	Product	Page
	PROJECT MANAGEMENT		
148	Primavera Systems	Project Management	82
	REMOTE COMPUTING		
*	Microcom	Carbon Copy for Windows	85
080	Ocean Isle Software	ReachOut Remote Control	267
	RESELLERS		
205	Compuclassics	Mail Order Products	411
108	COMPUTER DISCOUNT WAREHOUSE	Reseller	404-405
188	Dustin Discount Software	Mail Order & CD-ROM Products	334
347	Dustin Discount Software	Mail Order Products	342-343
010	Midwest Computer Works	Reseller	398
146	Pacific Wave Technology	Mail Order,Computers,Software	415
	SCANNERS/DIGITIZERS		
*	Epson America	Scanners	62-63
182	Logitech	ScanMan Color	127
314	Publishing Perfection	Software,Peripherals,Hardware	408
	SERVERS		
046	Tangent Computer, Inc.	Servers	346
*	Zenith Data Systems	Network Ready-Products	114-115
*	Zenith Data Systems	Network Ready-Products	124-125
	SOFTWARE		
091	Autodesk Retail Products	Generic CADD 6.0	100
300	Computability	Mail Order	390-391
177	Computer Express	Software	410
*	Dell Computer Corporation	Dell Systems/Software	78-79
*	Dell Computer Corporation	Dell Systems/Software	228-229
282	Hewlett Packard Dashboard	H.P. Dashboard	58
283	Macola, Inc.	Accounting & Windows Software	161
385	Managistics	Statgraphics	101
080	Ocean Isle Software	ReachOut Remote Control	267
146	Pacific Wave Technology	Software	415
198	PC Zones	Mail Order	394-395
028	Personics	Laptop Ultravision	4
373	Software Add-Ons	Software	400
101	TELEMART	Software	391
208	TELEMART	Software	393
	SPREADSHEET/TEMPLATES		
286	Borland International	QuattroPro for Windows	6
287	Borland International	QuattroPro for Windows	51
*	Lotus Development Corporation	1-2-3 for DOS	74-75
	STATISTICAL SOFTWARE		
385	Managistics	Statgraphics	101
080	Mathsoft Inc	Maple V	181
057	StatSoft	Statistical Software	83
	TRAVEL SOFTWARE		
221	Strategic Mapping, Inc.	LocalExpert	216
	UTILITIES		
282	Hewlett Packard Dashboard	H.P. Dashboard	58
028	Personics	Laptop Ultravision	4
350	Symantec Corporation	Norton Desktop for Windows	28
	VERTICAL MARKET SOFTWARE		
080	Mathsoft Inc	Maple V	181
	VIDEO GRAPHICS/BOARDS		
338	Arlington Computer Products	Mail Order	402-403
228	ATI Technologies Inc.	ATI Graphics Accelerators	88
300	Computability	Mail Order	390-391
324	Peripheral Express	Hardware/Peripherals	401
210	USA Flex	Peripherals	372-373
055	Video Seven	WIN.Pro End User	274
	WINDOWS SOFTWARE		
094	3-D Visions Inc.	Stanford Graphics 2.1	283
368	Adobe Systems Inc.	Illustrator for Windows	287
287	Borland International	QuattroPro for Windows	51
220	Borland International	Paradox for Windows	54-55
190	CalSoft	Software	80
400	Computer Associates	CA Ret/x base	5
250	Delrina Technology	Win Fax PRO 3.0	43
*	Lotus Development Corporation	Freelance Graphics	72-73
283	Macola, Inc.	Windows Software	161
080	Mathsoft Inc	Maple V	181
*	Microcom	Carbon Copy for Windows	85
381	Micrografx	ABC FlowCharter 2.0	41
*	Microsoft	Word for Windows	C2-C4,p1
*	Microsoft	Windows for Workgroups	102-103
*	Software Publishing	Harvard Graphics for Windows	10-11
057	StatSoft	Statistical Software	83
221	Strategic Mapping, Inc.	LocalExpert	216
350	Symantec Corporation	Norton Desktop for Windows	28
	WORD PROCESSING SOFTWARE/AIDS		
190	CalSoft	Software	80
*	Microsoft	Word for Windows	C2-C4,p1
	WORKSTATIONS		
213	Sigma Data	Upgrades	283

For Additional Categories See MARKETPLACE PRODUCT INDEX page 416.

PC MAGAZINE

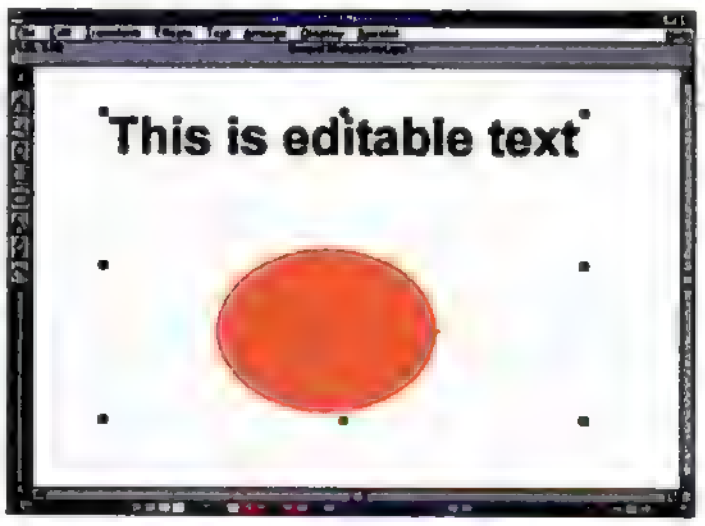
Coming Up

Graphics Boards

With new Windows accelerator cards deluging the market every day, trying to choose the best for your needs requires more pugnacity than ever. *PC Magazine* takes its second look this year at Windows accelerators with 1MB for the ISA and EISA buses, as well as a sampling for the VL-Bus—and all for under $1,000.

Surge Suppressors

Power-line surges can be lethal to your PC. The job of the surge suppressor is to protect your hardware and data from these potentially damaging overvoltages. *PC Magazine* tests 32 surge suppressors, ranging in price from $12.95 to $295, and finds that only about half of them are up to the task of stopping an electrical surge before it damages or destroys your valuable computer equipment. We also find that a high price tag does not necessarily guarantee the best protection.



Graphics capture and conversion utilities help navigate the gauntlet of file formats.

Graphics Utilities

Graphics file formats run the gamut through PCX, EPS, WMF, and at least six flavors of TIFF, but the elusive standard still remains. . .elusive. Enter graphics utilities. *PC Magazine* tests 12 packages that cover three of the four Cs—graphics conversion, capture, and 24-bit color. Some of them also include the fourth: compression, as well as a number of other useful tricks like color reduction and gamma correction. We'll help you decide which utility to buy.

Free Utility

With so many fonts to choose from in Windows, finding the one you want isn't always simple—or quick. You may be able to remember the difference between Times New Roman and Arial, but what does Bembo or Gatineau look like? Next issue's utility, FNTPRN.EXE, is your solution. It lets you easily view multiple fonts and then generate your own font catalog for handy reference. FNTPRN is a Windows 3.1–specific utility. □

Editorial Product Index

Reader Service No.	Product	Company	Page
423	ABC FlowCharter 2.0	Micrografx Inc.	49
500	ACS 4200	Advanced Computer Communications	244
467	Adobe Illustrator, Version 4.01	Adobe Systems Inc.	280
468	Aldus FreeHand, Version 3.1	Aldus Corp.	282
469	Arts & Letters Graphics Editor, Version 3.12	Computer Support Corp.	289
492	Aspen Personal 486	Aspen Computer Inc.	153
493	AST PowerExec 3/25SL	AST Research Inc.	160
494	BCC Avanti 486/V32 Model 200	BCC	166
495	BSI NB486DX2-50	Broadax Systems Inc.	166
496	CAF AquaLITE-II	CAF Technology Inc.	173
501	Cisco AGS+/4	Cisco Systems Inc.	245
409	CO/Session 6.1	Triton Technologies Inc.	64
497	Compaq Contura 3/25C	Compaq Computer Corp.	173
498	Compaq LTE Lite 4/25C	Compaq Computer Corp.	174
473	Compaq LTE Lite/25E	Compaq Computer Corp.	176
474	CompuAdd 425C	CompuAdd Computer Corp.	176
411	Computer Select	Computer Library	66
502	Constellation Pixis	Clearpoint Research Corp.	248
470	CorelDRAW, Version 3.0	Corel Systems Corp.	290
403	Dell KidStation	Dell Computer Corp.	59
403	Dell OfficeStation	Dell Computer Corp.	59
403	Dell StudentStation	Dell Computer Corp.	59
422	DeScribe Word Processor for OS/2 4.0	DeScribe Inc.	44
471	Designer 3.1 plus OLE	Micrografx Inc.	298
427	Diamond Viper VLB	Diamond Computer Systems Inc.	52
456	Energizer Bunny Screen Saver	PC Dynamics	450
476	Ergo Modular 486SLC NoteBrick	Ergo Computing Inc.	182
476	Ergo Modular Color 486SLC NoteBrick	Ergo Computing Inc.	182
477	Ergo Nifty Fifty 486/50 Color NoteBrick	Ergo Computing Inc.	187
408	EtherExpress 16C LAN Adapter	Intel Corp.	60
408	EtherExpress FlashC LAN Adapter	Intel Corp.	60
478	Expo Note 33	Expo Tech Inc.	187
415	Fargo Primera Color Printer	Fargo Electronics Inc.	46
424	FirstApps 2.0	hDC Computer Corp.	42
412	Fujitsu 325Point	Fujitsu Personal Systems Inc.	66
479	GRiD 1660C	GRiD Systems Corp.	188
414	Guide Line	Symantec Corp.	66
423	HALO Desktop Imager 2.0	Media Cybernetics Inc.	49
465	How Computers Work	Ziff-Davis Press	71
503	HP Router ER	Hewlett-Packard Co.	249
480	Hyundai Courier Spectra	Hyundai Electronics America	188
504	IBM 6611 Network Processor 140	IBM Corp.	252
481	IBM ThinkPad 300	IBM Personal Computer Co.	191
482	IBM ThinkPad 700	IBM Personal Computer Co.	191
482	IBM ThinkPad 700C	IBM Personal Computer Co.	191
460	Icon Hear-It	Moon Valley Software Inc.	452
416	ImagePals 2.0	U-Lead Systems	48
457	Johnny Castaway	Dynamix	450
425	Kinesis Ergonomic Keyboard	Kinesis Corp.	44
408	LANDesk Manager	Intel Corp.	60
401	LapLink V	Traveling Software Inc.	59
405	LaserMaster WinPrinter 360XLS	LaserMaster Corp.	60
458	Matinee	Access Softek	451
410	MAX/it	LINK Technologies Inc.	64
402	Maximizer for Windows 1.1	Richmond Technologies & Software Inc.	59
426	Micro Solutions backpack CD-ROM	MicroSolutions Computer Products	53
461	Microsoft Soundbits	Microsoft Corp.	452
430	Microsoft Windows Printing System	Microsoft Corp.	37
407	MIDIScan for Windows 1.0	Musitek	60
505	NCS 6607 Bridge-Router	Network Systems Corp.	259
428	NDI Volante Warp10LB LB	National Design Inc.	52
507	NETBuilder II	3Com Corp.	269
509	Network 9000 Intra-Networking Hub	Xyplex Inc.	270
483	Northgate ZXPortable 486DX/25	Northgate	194
483	Northgate ZXPortable Active Color	Northgate	194
508	Novell MultiProtocol Router, Version 2.0	Novell Inc.	264
451	Paradox Engine, Version 3.0, and Database Framework	Borland International	77
475	PC Brand 486/SLC Color LeaderBook	PC Brand Inc.	176
484	Poly NB433DX	Polywell Computers Inc.	196
472	Professional Draw, Version 1.0a	Gold Disk Inc.	303
506	Proteon ProNet DMX-300m	Proteon Inc.	266
409	ReachOut 3.2	Ocean Isle Software	64
485	Sharp PC-6881	Sharp Electronics Corp.	200
485	Sharp PC-7750	Sharp Electronics Corp.	200
417	Sherlock 1.0	Physiotronics Corp.	56
418	Sound Blaster 16 ASP	Creative Labs Inc.	40
462	Soundwav Pro 1, Soundwav Pro 2	Window Ware Inc.	452
463	Star Trek: The Next Generation	Sound Source Unlimited Inc.	452
463	Star Trek: The Original Television Series	Sound Source Unlimited Inc.	452
459	Star Trek: The Screen Saver	Berkeley Systems Inc.	451
466	The Streetwise Guide to PCs	Addison-Wesley Publishing Co.	71
406	Super-TCP for Windows	Frontier Technologies Corp.	60
486	Swan 486/SLC-25 Notebook	Swan Technologies Inc.	201
429	Tektronix Phaser 200i	Tektronix Inc.	37
487	Tenex Notebook 386DXL/33	Tenex Computer Express	202
488	TI TravelMate 4000 WinDX2/50	Texas Instruments Inc.	207
488	TI TravelMate WinSLC	Texas Instruments Inc.	207
489	Toshiba T4400C	Toshiba America Information Systems Inc.	216
490	Transource Verxion NB8004	Transource Computers	217
419	TurboCAD Professional 1.0 for Windows	IMSI	50
463	2001: A Space Odyssey	Sound Source Unlimited Inc.	452
491	U.S. Professional Notebook 486DX	U.S. Systems and Technologies Inc.	218
404	WinBEEP 1.0	Fourth Wave Technologies Inc.	59
413	WinMail 1.5	Powercore International Inc.	64
420	Zylmage 1.0	ZyLab	56

TECHNICAL COLUMNS

User-to-User	Find the length of a string by turning a DOS limitation into an asset	309
Tutor	Viruses: How They Work and How to Avoid Them	311
Utilities	Quick-Boot Your PC and Protect Your Data with BOOT2C and BOOTPW	314
Environments	An Introduction to OS/2 Outline Fonts	322
Power Programming	Export Tables in Windows NT Executable Files	329

SOLUTIONS

PCs	Obtain distribution disks for programs preinstalled on new PCs	344
PCs	Ways to keep your notebook's battery charged	344
Operating Environments	Uncovering the hidden Windows swap file	345
Operating Environments	New features of the ATTRIB command in DOS 5.0	345
Word Processing	Reformat a paragraph to match the format of a previous one	347
Spreadsheets	A clever way to include functions in EXCEL's chart series formulas	347
Databases	Finding the beginning and end of the month in Paradox	349
Databases	Converting text to Proper format in dBASE	351
Graphics	Creating scalable fonts in foreign languages for TrueType and PostScript	351
Graphics	Getting .EPS files to print correctly in landscape mode	354
Networking	Make sure to install unshielded twisted-pair wire properly	354
Networking	Using analog modems with digital phones	363
Languages	BASIC and C programs that illustrate how to access the video buffer directly	363
Vertical Applications	Manage your hotel or motel more efficiently with specialized software packages	378

After Hours

SCREEN SAVERS: PC Dynamics' Energizer Bunny; Dynamix's Johnny Castaway; Access Softek's Matinee; Berkeley Systems' Star Trek: The Screen Saver **SOUND BITES:** Moon Valley Software's Icon Hear-It; Microsoft Soundbits; Window Ware's Soundwav Pro; Sound Source Unlimited's Star Trek and 2001: A Space Odyssey; Aristosoft's Wired For Sound Pro

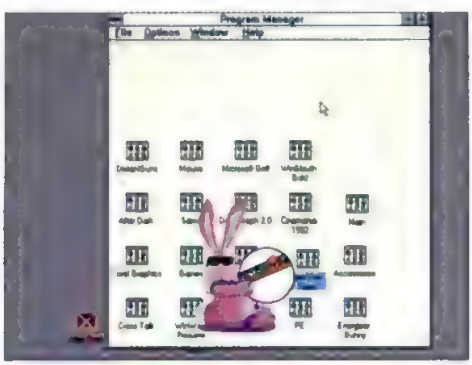
SCREEN SAVERS

From Tribbles to Castaways: Screen Savers for all Tastes

BY DONALD B. TRIVETTE

Consider the rise of the lowly screen saver: In addition to its utilitarian function, it now brings a bit of glitz, glamour, and entertainment to your homely computer screen. It's the Chia Pet of the electronic cottage, computer tinsel at its finest. Here are four new Windows screen savers that deserve special attention.

First—and you're never going to believe this—there's PC Dynamics' Energizer Bunny, perfect for PC users who don't mind turning their monitors into a battery commercial. Then there's Dynamix's Johnny Castaway, one of the only screen savers we've ever seen that actually has a plot. We'll also take a look at Access Softek's Matinee, the first full-motion screen saver—complete with almost 40 short video clips. And, finally, we'll review Berkeley Systems' Star Trek: The Screen Saver—for true Trekkie hackers who want their PC screens to look like a Sickbay Monitor.



Still going! The Energizer Bunny marches across Windows spreadsheets and desktops.

PC DYNAMICS

Energizer Bunny Screen Saver

It's true. Eveready's Energizer Bunny, the most unlikely television commercial hero, makes his debut on the tiny screen in the Energizer Bunny Screen Saver. PC Dynamics has licensed the rights and developed a trilogy of Energizer Bunny showstoppers.

First, when you run the program in guest-appearance mode, the Energizer Bunny randomly appears on your screen—right on top of your Microsoft Windows-based spreadsheet, word processor, solitaire game, or any other application. When the computer sits idle for five minutes, the bunny makes a guest appearance; as soon as you begin work again, he vanishes.

Guest-appearance activities are inspired by the famous television commercials. There are strolls across the screen with half a dozen drum-beating variations, which include a masked bunny, a parachuting bunny, and an underwater bunny. Each has appropriate sound effects and a sound bite plugging the battery. Granted, this is blatant commercialism, but the Energizer Bunny has become so much a part of our pop culture that it's forgivable.

These same scenes also appear in a true screen-saver mode and in wallpaper mode. The latter has nine bunny motifs, any one of which would look quite handsome on computers in Eveready's corporate offices.

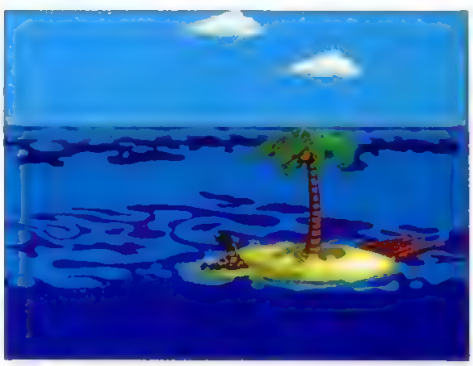
Energizer Bunny Screen Saver, *$24.95.* Requires: *2MB RAM, Microsoft Windows 3.0 or later, 3MB hard disk space. PC Dynamics, 31332 Via Colinas, # 102, Westlake Village, CA 91362; 818-889-1741, 800-888-1741; fax, 818-889-1014.*

Circle 456 on reader service card

DYNAMIX

Johnny Castaway

Johnny Castaway, from Dynamix, tells the compelling tale of poor Johnny, shipwrecked on a one-palm island in the middle of the ocean. Johnny, looking suspiciously like Leisure Suit Larry with a beard, has one misadventure after another. Lightning strikes, sharks attack, a mermaid entices, rescues fail. Those are just a few of the animated antics—complete with sound effects—that unfold. There are thousands of different animations and combinations.



Will Johnny Castaway ever escape his desert island? Stay tuned for the next screen-saving installment.

Underneath the cool cartoons, Johnny Castaway really is a screen saver. No dot of phosphorus would dare burn the screen while our hero is on the lookout. Every few minutes there are changes, sometimes subtle: The island shifts, clouds move, night falls, the moon comes out.

There are also special events for holidays. On Halloween, Johnny carves up a pumpkin, and on December 25, he puts up a Christmas tree. (If you aren't around the computer on holidays, just reset the system date to check out the action.)

In addition to random antics and holiday specials, how-

Johnny Castaway

ever, a cohesive plot runs through the story and advances a little each day. It takes about 120 days—that's 120 days once you start Windows—to complete the tale. Johnny slowly builds a raft, he corresponds with a woman in New York via a glass bottle, and he eventually tries to escape. Does he succeed? You'll have to bring up Windows every day to advance the story.

Johnny Castaway, *$34.95.* Requires: *2MB RAM, Microsoft Windows 3.1, 1.4MB hard disk space; 3.5-inch disks only. Dynamix, 99 West 10th, #224, Eugene, OR 97401; 800-326-6654, 503-343-0772; fax, 503-344-1754.*

Circle 457 on reader service card

ACCESS SOFTEK

Matinee

If you've ever aspired to the Hollywood cutting room, Access Softek's Matinee will delight you. Matinee is the first screen saver that uses full-motion video clips and lets you combine them in any order to create your own minimovies.

Access Softek squeezes 38 2- to 5-second clips—roughly 2 minutes of video—into a 3.6MB program, using a proprietary compression scheme. How you combine those shots is up to you. Make a breakfast screen saver, for example, by combining a clip of eggs hitting a sizzling pan with Matinee's answer to Flying Toasters: two slices of perfectly browned bread flinging themselves out of a toaster. Follow up with a pair of smacking red lips.

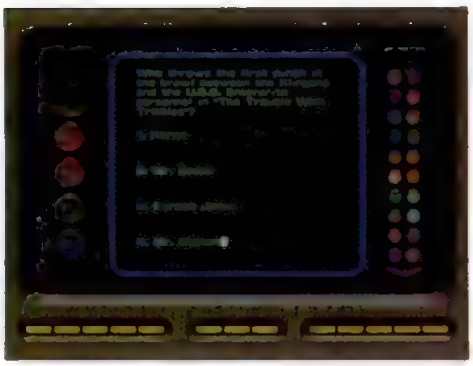
Make your own screen saver. You're the producer in Matinee's video editing room.

You can adjust the frame rate from 5 to 30 frames per second. The higher the rate, the smoother the appearance of the clip; consider 30 frames per second full-motion video.

Matinee's film clips come from public-domain movies and cartoons; only a few of them feature familiar scenes, such as Neil Armstrong walking on the moon. Access Softek is shipping 10 additional film-clip packages: nostalgia, monsters, dancing, sports, cartoons, space, nature, humor, bikinis, and biceps. Each comes with 10 to 15 clips and sells for $19.95. You can't add your own video files to the screen saver, however: Although the files have an .MPG extension, they are not compatible with the Motion Picture Experts Group (MPEG) standard.

The weakest part of the package is the quality of backdrops on which the movies play. Access Softek gives you four choices. The art-deco television set is reminiscent of the Jetsons, and the movie theater is rendered in an ugly black, chartreuse, and rust color combination. The newspaper is pretty dull. Fortunately, you can use any .BMP file—including your Windows desktop—as a backdrop. With this option, you can also place the video anywhere on the screen.

Matinee produces two Windows icons: the Matinee Editing Room and Matinee Play. In the editing room, you can create your film, select its frame rate and backdrop, and choose a password. When satisfied with your results, set Matinee as your screen saver under Windows 3.1's Control Panel.



Trouble a tribble or test your Trekkie IQ in Berkeley Systems' Star Trek: The Screen Saver.

Matinee, *$49.95.* Requires: *4MB RAM, Microsoft Windows 3.1, 256-color display, 3.6MB hard disk space. Access Softek, 2550 9th St., # 206, Berkeley, CA 94710; 510-848-0606; fax, 510-848-0608.*

Circle 458 on reader service card

BERKELEY SYSTEMS

Star Trek: The Screen Saver

Now your toasters can fly with the Enterprise. Star Trek: The Screen Saver adds 15 new modules to the original After Dark interface. Each screen saver pays tribute to a popular Star Trek feature, such as the Final Frontier opening sequence, Scotty's Files, Spock, Tholian Web, and everyone's favorite furballs, the Tribbles.

The package installs its own Randomizer and Multi-Module control panels, which allow you to combine the modules any way you like to personalize your screen saver. If you have the original interface, the Star Trek modules are automatically added to the collection and can be combined with any other module.

For Trekkie trivia fans, there's a final exam with hundreds of multiple-choice questions. By pressing the Num-Lock key, you can disable keyboard reset and enter answers without actually disrupting the screen saver. Here's a pop quiz, taken from some of the screens: What is the number on McCoy's cabin? *(1) 5D 137 (2) 4C 288 (3) 2B 149 (4) 3F 127.* What color are Number One's fingernails in "The Cage"? *(1) Red (2) Blue (3) Green (4) Yellow.*

In addition to great graphics, some of the modules have audio clips from the original television series. Along with the voices of Captain Kirk, Mr. Spock, Bones, and Scotty, you can hear the trilling of the Tribbles and the sucking of the Brain Cells. You'll hear the sounds on a PC speaker, but a sound card provides much better results.

(By the way, McCoy's cabin number was 3F 127, and Number One's nails were blue.)

Star Trek: The Screen Saver, *$59.95.* Requires: *2MB RAM, Microsoft Windows 3.0 or later, 2MB hard disk space. Berkeley Systems Inc., 2095 Rose St., Berkeley, CA 94709; 800-344-5541, 510-540-5535; fax, 510-540-5115.*

Circle 459 on reader service card

SOUND BITES

Speak Out! 10 Sound-Clip Libraries Give Voices to Windows

BY DONALD B. TRIVETTE

Now that so many of us have sound cards and Microsoft Windows, software developers are turning out sound-clip software with a vengeance. Some of these 10 Windows-compatible products claim to work without an optional sound card; technically they do, but the quality is poor due to the small, tinny-sounding speaker that is standard on PCs. We strongly recommend a sound card.

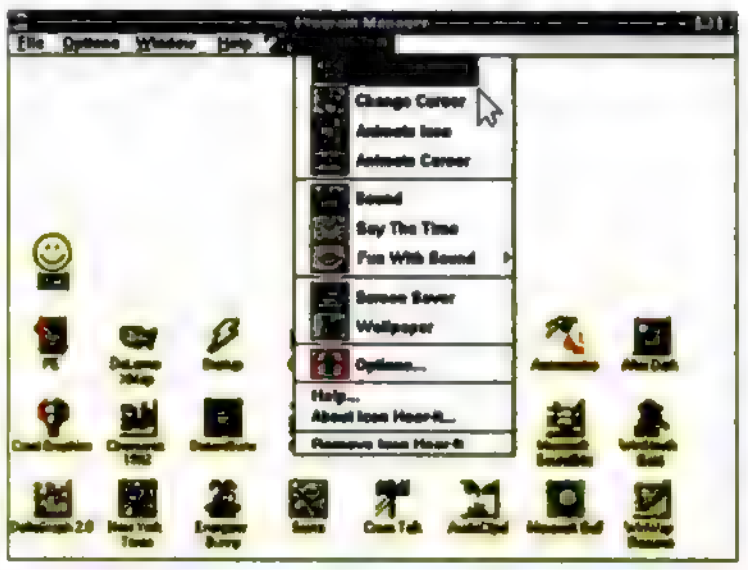
MOON VALLEY SOFTWARE

Icon Hear-It

Although Icon Hear-It doesn't have as many sounds as Aristosoft's Wired for Sound Pro, it does have some nifty features. Chief among them is the ability to replace the boring, generic Windows group icons with colorful, descriptive ones. You might choose a big happy face for the main group, a lightning bolt for the start-up group, and a striped balloon for CorelDRAW. Shame on Microsoft for not making this a standard Windows feature.

Icon Hear-It comes with 20 animated cursors and 50 animated icons; it even includes some popular program logos. The Lotus 1-2-3 icon, for example, shows the familiar 1-2-3 logo changing through a rainbow of color. Animated cursors are an even more exotic adornment. Like a screen saver, the animated cursor comes to life after a preset number of seconds passes without activity. In one case, the cursor turns into a bird and flies across the screen.

Icon Hear-It has fewer sounds than Wired For Sound Pro, but it can still make a respectable racket with its 100 or so choices. There's a talking calculator, a talking clock that can be set to speak every quarter hour, and a talking enhancement—complete with a cheat option—to Windows Solitaire. Click on any card, and Icon Hear-It will tell you what it is.



Sure cure for dull desktops: Animated icons and more than 100 sounds are included in Icon Hear-It.

Icon Hear-It can be run like a standard Windows application, or it can become a pull-down window on Program Manager's menu bar. The latter feature makes Icon Hear-It easy to run and makes the program seem like an integral part of Windows.

Icon Hear-It, *$49.95.* Requires: *2MB RAM, Microsoft Windows 3.0 or 3.1, 3MB hard disk space, sound card recommended. Moon Valley Software Inc., 706 E. Bell Rd., #112, Phoenix, AZ 85022; 800-847-3546, 602-375-9502; fax, 602-993-4950.*

Circle 460 on reader service card

MICROSOFT

Soundbits

Microsoft is offering three different sound-clip packages: Musical Sounds, Hanna-Barbera Cartoons, and Hollywood Movies.

The first features 50 brief musical creations played on banjo, guitar, oboe, sax, steel drum, and violin.

With the Hanna-Barbera Cartoons collection, you can choose from 50 sound clips of some of 'Toondom's greatest characters, such as Yogi Bear and Scooby-Doo.

Some people never get sick of hearing classic movie lines such as, "I'll get you, my pretty! And your little dog too!" You can choose Hollywood Classics to get dialogue from 50 classic movies, including not only *The Wizard of Oz* but also *The Maltese Falcon, The Thin Man,* and *North by Northwest.*

Microsoft Soundbits, *$39.95 each.* Requires: *2MB RAM, Microsoft Windows 3.1, sound card, 2MB hard disk space. Microsoft Corp., One Microsoft Way, Redmond, WA 98052; 800-426-9400, 206-882-8080; fax, 206-883-8101.*

Circle 461 on reader service card

WINDOW WARE

Soundwav Pro

Window Ware produces two Soundwav Pro packages. Soundwav Pro 1 contains 78 cartoon, movie, and television bits, including clips of Bugs Bunny, the Jetsons, Yosemite Sam, Popeye, Bullwinkle, the Simpsons, Dirty Harry, and Crocodile Dundee, and the movies *Star Wars* and *The Wizard of Oz.* There's a small manual that suggests where the clips might be appropriate.

Soundwav Pro 2 features 54 sound clips for the politically savvy. Among them are clips of Spiro Agnew, Richard Nixon, Harry Truman, George Bush, and Winston Churchill. The package also features sound effects such as thunder and lightning, a flushing toilet, breaking glass, screeching tires, and a lawn mower. The collection includes a few TV and movie clips, such as Alfred Hitchcock's famous greeting, "Good evening. . ."

Soundwav Pro 1, Soundwav Pro 2, *$29.95 each.* Requires: *2MB RAM, Windows 3.1 or later, 4MB hard disk space. Window Ware Inc., 1450 Concordia Ave., St. Paul, MN 55104; 800-426-9400, 612-544-8581; fax, 612-644-7410.*

Circle 462 on reader service card

SOUND SOURCE UNLIMITED

2001: A Space Odyssey
Star Trek: The Original Television Series
Star Trek: The Next Generation

Sound Source Unlimited gives you three sci-fi choices: Both the original and Next Generation verions of Star Trek and 2001: A Space Odyssey. The packages contain between 70 and 80 clips from each.

2001 features 77 clips from the classic movie, such as "I'm sorry Dave, I'm afraid I can't do that." There are also a number of sound effects, such

Star Trek

as lasers and alarms.

Star Trek: The Original Television Series contains 70 clips, including authorized digital sound effects, phasers, photons, musical cues, and the voices of Spock, Captain Kirk, and Bones McCoy. Fans of Star Trek: The Next Generation will be interested in the third package, which contains 74 clips of dialogue, sound effects, and music from the pilot episode of the show.

2001: A Space Odyssey, *$69.95;* **Star Trek: The Original Television Series,** *$59.95;* **Star Trek: The Next Generation,** *$69.95.*
Requires: *Microsoft Windows 3.1, 2MB to 5MB hard disk space. Sound Source Unlimited Inc., 2985 E. Hillcrest Dr., Suite A, Westlake Village, CA 91362; 800-877-4778, 805-494-9996; fax, 805-495-0016.*
Circle 463 on reader service card

ARISTOSOFT

Wired For Sound Pro

Wired for Sound Pro lets you change almost everything about the way Windows sounds and looks, from icons to cursors. There are hundreds of colorful little pictures that can be substituted for applications' standard icons. If you are unhappy with the standard Windows pointer, you can change that cursor; you can also adjust the wait, I-beam, crosshair, and other cursors. Among the 100 choices are fingers, stars, and happy faces.

Once you get the visuals set to your liking, you can concentrate on sounds. True to its name, Wired for Sound has hundreds of sound and voice clips that can be attached to Windows events. When you close an application, for example, you can hear a round of applause or a cow mooing. My own favorite is the frail voice saying, "I've fallen, and I can't get up," when a Windows error occurs.

Fool the boss into thinking you're hard at work or just fool around with Wired For Sound Pro's icons and sounds.

Wired For Sound Pro includes utilities such as a talking clock, talking calculator, talking calendar, talking Solitaire, and an odd little feature called a JobSaver. This soundtrack features keyboard clicks, throat clearing, and the occasional cough; the idea is that you can take a nap in your office, and no one will notice. □

Wired For Sound Pro, *$79.00.*
Requires: *2MB RAM, Microsoft Windows 3.0 or 3.1, sound board, 7MB hard disk space. Aristosoft Inc., 7041 Koll Center Pkwy., # 160, Pleasanton, CA 94566; 800-338-2629, 510-426-5355; fax 510-426-6703.*
Circle 464 on reader service card

Turn your
excess inventory
into a tax break
and help send needy
kids to college.

Call for your
free guide
to learn how donating your
slow moving inventory
can mean a generous
tax write off
for your company.

Call **708-690-0010**
PETER ROSKAM
Executive Director

EAL

P.O. Box 3021, Glen Ellyn, IL 60138
Fax (708) 690-0565

Claudia did not have the finances to finish college. Excess inventory donations to EAL gave her the scholarship she needed to graduate. Claudia is now with a leading financial trading firm, happily married with twin daughters.

Excess inventory today...student opportunity tomorrow

Abort, Retry, Fail?

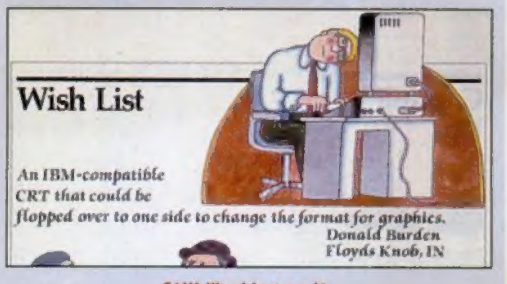
THE LIGHTER SIDE OF PERSONAL COMPUTING

By Robin Raskin

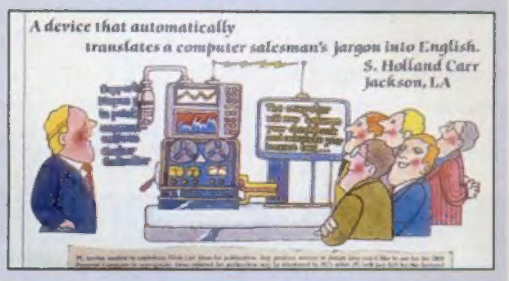
10 YEARS AGO IN *PC MAGAZINE*

From a list on this page ten years ago:

Wishes that Made It (the Radius Pivot)



Still Working on It



Who Said the Car/Computer Analogy Was Dead?

The MotorMouse (from Motor Mouse Products, 604-681-6062) is a bona fide MS-compatible mouse that even comes with its own cruise-control mouse "driver." You can choose the color and model of your car icon, set the speed, and even click the center mouse button to hear a "beep beep."

Press Releases We Never Finished Reading

"Features Comparison Between Word For Word-Windows Edition, Word for Word, Word for Windows Version and Word for Word Professional Version"
—*MASTERSOFT PRESS RELEASE*

Top Ten Reasons Apple and Novell Should Merge

10. Mormon Tabernacle Choir gains a trendy new repertoire.
9. Utah won't slide into the ocean if the big quake hits.
8. Apple's sprout-centric diet and Novell's ice cream–centric diet make for some intriguing new flavors.
7. Immediate improvements to Novell's Frisbee and Hacky Sack teams.
6. More fans to attend Utah Jazz home games.
5. "Sculley and Noorda" sounds cool, like "Starsky and Hutch."
4. Male Apple programmers driven by a deluded belief that polygamy is still legal.
3. Potential names are intriguing ("Nopple," "Appell," "John and Ray's Billion-Dollar Baby").
2. Think of the first Christmas party.
1. Ray Noorda needs to loosen up.

You'll need a consenting lap-neighbor or you'll look pretty suspicious with your hands tucked under your tray as you try to use this MouseMate device on an airplane ride! (Comptors, 404-487-4741.)

If your entry is used in Abort, Retry, Fail? we'll send you $50 and a *PC Magazine* T-shirt. Winners this issue: Windows tongue twister (Don Willmott), AppleNet (Emerson A. Torgan).

DELL CUTS PRICES.

IBM AND COMPAQ REACT WITH A FEW CHOICE WORDS.

PC MAG
LIBRARY

FROM NOW UNTIL APRIL FOOL'S DAY THE JOKE'S ON IBM AND COMPAQ.

DELL PERFORMANCE SERIES
425s/L i486 SX 25MHz

NOW $1,599

(SAVE $469)

Laugh while you can.
All good things must come to an end. This offer, for instance, ends March 31.

All this for just $1,599? HA HA HA HA HA HA HA HA HA!

DELL® 425s/L i486™ SX 25MHz SYSTEM

- LEASE¹: $59/MO.
- 4MB RAM
- 170MB (17ms) HARD DRIVE
- 3 ISA EXPANSION SLOTS
- UPGRADEABLE PROCESSOR
- ACCELERATED LOCAL BUS VIDEO WITH 512KB VIDEO RAM
- ULTRASCAN™ 14C MONITOR (14", 1024 x 768, .28mm, NI)
- DUAL DISKETTE DRIVES (3.5" AND 5.25")
- MS-DOS® 5.0/MICROSOFT® WINDOWS™ 3.1/ MOUSE

intel inside

Very Serious Video Performance.
Our accelerated local bus video gives you up to three times the video speed of IBM ValuePoint's or Compaq Prolinea's non-local bus video†. Which makes them look, well, laughable.

DELL™

800-348-8342

WHEN CALLING, PLEASE REFERENCE **#11BDF**.
HOURS: 7AM-9PM CT MON-FRI, 8AM-4PM CT SAT, 10AM-3PM CT SUN.
IN CANADA, CALL 800-668-3021. IN MEXICO CITY, 228-7811.